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RUBUS and *RIBES*—A SURVEY

by

R. L. KNIGHT and ELIZABETH KEEP

Technical Communication No. 25
Commonwealth Bureau of Horticulture and Plantation Crops
East Malling, Maidstone, Kent

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Amphorophora rubi (Kalt.), vector of several raspberry viruses. Breeding for resistance to both vector and viruses is in progress.

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FOREWORD

This survey deals almost exclusively with literature published between 1900 and 1955 although a few items of earlier date have been included. The crops covered are currants, gooseberries, raspberries, blackberries and hybrid berries. Bearing in mind the particular needs of practical fruit breeders we have collected information from a wider range of literature than would normally be covered by abstracting journals dealing with this aspect of horticulture. (Specialist abstracting journals in this field have existed for less than thirty years.) Papers and reports bearing on the breeding, genetics and cytology of *Rubus* and *Ribes* have been summarized in detail, but the field has also been extended to include pomological descriptions, the classification and synonymy of varieties and species, and their disease and pest response. In addition gene lists and linkage data are given in appendices. Papers dealing solely with the systematic botany of these two genera have been included by title only.

We gratefully acknowledge the varied help received from East Malling Research Station and from the Commonwealth Bureau of Horticulture and Plantation Crops. Acknowledgement is also made to Mr. S. R. Ball, Librarian of East Malling Research Station, for all the help he has given in obtaining the originals of many of the more obscure references. Considerable use has been made of abstracting journals, especially Plant Breeding Abstracts and Experiment Station Record; acknowledgement is made in the text in such cases.

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30th September 1958

ABSTRACT BIBLIOGRAPHY

1900—1955

Adam, W. B. 1931-34. *See* **Hirst, F.,** and **Adam, W. B.**

Adam, W. B. 1947. *See* **Hirst, F.,** and **Adam, W. B.**

1. Adams, J. 1916. On the germination of the pollen grains of apple and other fruit trees. *Bot. Gaz.*, **61,** pp. 131-47.
Pollen grains of strawberry, loganberry and raspberry were dead after two months' dry storage, those of black currant after eleven weeks.

2. Alderman, W. H. 1933. Fruit growers' problems. New fruits named—Superior plum—Red Lake currant. *Minn. Hort.*, **61,** p. 13.
Red Lake was selected from seedlings of unknown parentage. It is a late, high yielding currant.

3. Alderman, W. H. 1948. Fruit breeding—past, present and future. *Proc. Amer. Soc. hort. Sci.*, **51,** pp. 670-84.
A review of fruit breeding at experiment stations in Canada and U.S.A. Lists of the stations and of the fruits being bred are included.

4. Allander, H. 1941. (On the Swedish so-called *Rubus nemorosus.*) *Svensk bot. Tidskr.*, **35,** pp. 287-95.
A detailed description of this 2n=28 species is given and the name *R. aureolus* is proposed for it.

Amos, J. 1921. *See* **Wellington, R., Hatton, R. G.,** and **Amos, J.**

Amos, J. 1927. *See* **Hatton, R. G.,** and **Amos, J.**

5. Amos, J., Hatton, R. G., Knight, R. C., and **Massee, A. M. 1927.** Experiments in the transmission of 'reversion' in black currants. *Rep. E. Malling Res. Sta. for 1925, Suppl.*, pp. 126-50.

6. Amos, J. 1929. Red currant varieties. *Rep. E. Malling Res. Sta. for 1928, General*, pp. 73-9.
The classification given is accessory to that of Bunyard (1917) and a key is provided to identification, based primarily on leaf characters.

7. Amos, J. 1931a. Three 'rogue' varieties of black currants. *Rep. E. Malling Res. Sta. for 1930, General*, pp. 55-60.
Three types of inferior rogue which have several times been received as Baldwin Black are described.

8. Amos, J. 1931b. Some 'rogue' varieties of black currants. *Rep. E. Malling Res. Sta. for 1928, 1929, 1930, Suppl.*, pp. 46-9.
This paper is almost identical with Amos (1931a), above.

9. **Amos, J., Hatton, R. G.,** and **Hoblyn, T. N. 1942.** How to improve black currant plantations. *Rep. E. Malling Res. Sta. for 1941*, pp. 53-6.

Part of this paper reviews the available information on black currant varieties. Baldwin does exceedingly well on good soils but often makes insufficient growth on light sands and heavy clays. Wellington XXX is so vigorous that it crops well under both these conditions. If early fruit is required and shelter and moisture are satisfactory, Boskoop Giant holds the field. The Goliath group, though sulphur shy and very susceptible to adverse soil conditions, usually produce the largest and sweetest fruits. Davison's Eight is an early-fruiting sub-type of this group. Of the French group, Seabrook's Black though hardy requires shelter for the best results. Wellington XXX and Mendip Cross are very alike; they resemble the Boskoop group but are more spreading and set their fruit more freely. They are mid-season. Westwick Choice is a close relative of Baldwin but is slightly later.

Anderson, H. W. 1926. *see* **Colby, A. S.,** and **Anderson, H. W.**

10. **Anderson, J. P. 1943.** Two notable plant hybrids from Alaska. *Proc. Ia Acad. Sci.*, **50**, pp. 155-7.

The author describes a naturally occurring, sterile hybrid of *Ribes bracteosum* Dougl. × *R. laxiflorum* Pursh. Crosses between *R. bracteosum* and *R. nigrum*, made in 1914, produced fertile progeny.

11. **Anderson, O. C. 1939.** A cytological study of resistance of Viking currant to infection by *Cronartium ribicola*. *Phytopathology*, **29**, pp. 26-40.

Cronartium ribicola can infect young, fully expanded leaves of Viking red currant but the young hyphae die quickly, leaving minute necrotic flecks on the leaves. The resistance of Viking appears to be biochemical rather than anatomical.

12. **Anderson, R. L.,** and **French, D. W. 1955.** Evidence of races of *Cronartium ribicola* on *Ribes*. *For. Sci.*, **1**, pp. 38-9.

Four collections of *Cronartium ribicola* A. Fisch. from *Pinus lambertiana* caused large necrotic areas on leaves of clonal *Ribes hirtellum* Michx., while five collections from *P. strobus* and one from *P. monticola* Dougl. produced large chlorotic spots with no necrosis. These results indicate the existence of races of *C. ribicola*.

Viking (*R. petraeum* Wulf. × *R. rubrum* L.) and *R. viburnifolium* A. Gray did not become infected by any of the spore collections used.

13. **Andreičenko, D. A. 1938.** (Let us utilize the many wild bush fruits of eastern Siberia.) *Plodoovoščnoe Khozjaistvo* (Fruit and Veg. Gr.), No. 3, pp. 56-62. (Condensed from *Plant Breed. Abstr.*, **8**, p. 491.)

Various species of *Ribes* are described and illustrated, with indications of characters of economic significance. *R. dikuscha* is of particular interest, combining unusual frost resistance with high yields of large fruit.

Certain forms of *Rubus idaeus* sub sp. *vulgatus* combine frost resistance with high yields, size of fruit and good flavour; the sub sp. *melanosius* [*melanolasius*] is exceptionally frost resistant but of poor quality.

14. Angelo, E. 1938. Experiences in propagating *Rubus* and other species by leaf-bud cuttings. *Proc. Amer. Soc. hort. Sci.*, **35,** pp. 448-50.
The method described gave 95% of 'takes' with black raspberries and also proved successful with purple cane hybrids and with gooseberries.

15. Angelo, E. 1939. The use of chemicals in rooting raspberry leaf-bud cuttings. *Proc. Amer. Soc. hort. Sci.*, **36,** pp. 129-30.

16. Anonymous. 1903. The white blackberry 'Iceberg'. *Sci. Amer.*, **88,** p. 358. (Condensed from *Exp. Sta. Rec.*, **14,** p. 1071.)
An account of the origin of Burbank's Iceberg. The fruit is white and as firm as Lawton.

17. Anonymous. 1904. Floral Committee, May 19, 1903. *J. roy. hort. Soc.*, **28,** p. lxvi.
Rubus moluccanus (syn. *R. reflexus*), a greenhouse climbing species with ornamental foliage, was introduced from the Malay Archipelago.

18. Anonymous. 1914. The time of blossoming of fruit trees. *Rep. Long Ashton Res. Sta.*, pp. 107-16.
Dates of blossoming are given for various varieties of fruit, including raspberries, gooseberries and currants.

19. Anonymous. 1915. Black currants. *Rep. Wye Coll. Fruit Exp. Sta., Feb. 1915*, pp. 5-6 (typescript).
It is considered that 'running-off' is a matter of pollination as affected by the relationship between length of style and of stamens.

20. Anonymous. 1917. Raspberry November Abundance. *Gdnrs' Chron.*, **42,** p. 107.
November Abundance, bred by Allgrove from Superlative × Catawissa, ripened its first fruits on 22 July.

21. Anonymous. 1920. Two new raspberries. *J. Pomol.*, **1,** p. 243.
Pyne's Royal, introduced in 1913, has very large fruit. Park Lane, first introduced in 1912, is one of the sweetest fruits grown, though too soft for market.

22. Anonymous. 1920. Horticultural activities at the Texas station. *Rep. Tex. agric. Exp. Sta.*, pp. 8-10.
The origin of the A & M Berry [Ness-Berry] is given. [*See* Abstr. 677.]

23. Anonymous. 1921. Horticulture. *Bull. N. Dak. agric. Exp. Sta.*, **146,** pp. 40-1.
Three red raspberry varieties, Sunbeam, Ohta, and Latham, survived the winter of 1919-20 without protection. Latham was by far the heaviest yielder of the three.

24. Anonymous. 1922. Fruit and vegetables. *Bull. Ark. agric. Exp. Sta.*, **181,** pp. 71-83, 86, 87. (Condensed from *Exp. Sta. Rec.*, **47,** pp. 739-41.)
Early Harvest blackberry is susceptible to rust; Snyder is more vigorous and less subject to rust. McDonald, largely self-sterile and more or less trailing, is considered valuable for southern Arkansas when interplanted

with compatible varieties such as Lawton, Haupt, or Early Harvest. Lawton is recommended for southern Arkansas, while Dallas and Eldorado are considered promising for the northern part.

25. Anonymous. 1923. Report of the Chief of the Bureau of Plant Industry. *Bull. U.S. Bur. Plant Ind.*, 34 pp.
All the 16 north-western species of *Ribes* naturally or artificially infected with *Cronartium ribicola* in greenhouse tests were found to be susceptible, particularly *R. bracteosum* and *R. petiolare*.

26. Anonymous. 1924. Fruit research. II. In relation to the small fruits *Rep. E. Malling Res. Sta. for 1923*, pp. 88-9.
Second generation selfs from the principal black currant varieties were raised. Seedlings of Boskoop Giant, Goliath (Victoria type), and Baldwin usually resemble the parent, but seedlings of French and Seabrook's show a large percentage of curious forms not hitherto seen in cultivation.

27. Anonymous. 1925. (Gooseberry mildew.) *Kranke Pflanze*, **2** (4), p. 78.
American Mountain, Green Giant, May Duke, White Fullbearing, and Jenny Lind are resistant to gooseberry mildew.

28. Anonymous. 1926. Department of botany and plant pathology. *Bien. Rep. Ore. agric. Exp. Sta., 1925-26*, pp. 90-6.
Phragmidium imitans seriously affects Cuthbert raspberry. Studies on stomatal distribution are believed to indicate that *Ribes nigrum*, *R. sanguineum*, and *R. divaricatum* are susceptible to white pine blister rust in the order named.

29. Anonymous. 1926. Horticultural investigations. *Rep. Ga Sta.*, pp. 142-9.
The crosses Loganberry × Haymaker raspberry, Himalaya blackberry × Golden Queen raspberry, and Himalaya × Van Fleet were successful. Van Fleet raspberry proved self-sterile.

30. Anonymous. 1927. A year's progress in solving farm problems of Illinois, 1926-27. *Rep. Ill. agric. Exp. Sta.*, **40,** 288 pp. (Condensed from *Rev. appl. Mycol.*, **7,** pp. 428-9.)
A number of native gooseberry varieties selected for resistance to *Mycosphaerella grossulariae* were found to show 4-5% infection, while some of Canadian origin exhibited up to 22·5%. The Minnesota varieties, Carrie and Como, showed 34 and 45% infection, respectively, while 46% of the variety Poorman were diseased. Most of the so-called English gooseberries showed heavier infection, ranging from 60% on Portage to 78% on Whitesmith. Downing and Oregon Champion showed 79 and 85% infection respectively.

31. Anonymous. 1928. Horticultural investigations at the Kentucky Station. *Rep. Ky agric. Exp. Sta., Pt I*, pp. 29-30.
Quillen black raspberry showed high resistance to anthracnose.

32. Anonymous. 1928. A year's progress in solving farm problems of Illinois, 1927-28. *Rep. Ill. agric. Exp. Sta.*, **41,** 321 pp. (Condensed from *Rev. appl. Mycol.*, **8,** pp. 292-3.)
Perfection proved very susceptible to raspberry mosaic, while the everbearing St. Regis [Ranere] proved resistant. Besides Royal and Quillen

black raspberries, Black Pearl, Cumberland, Honey Sweet, and Older have produced progeny showing varying degrees of resistance to anthracnose [*Elsinoë veneta*]. The range of susceptibility suggests that this character is controlled by more than one gene.

33. Anonymous. 1929. (Plant diseases in Denmark in 1928.) *Tidsskr. Planteavl*, **35**, pp. 420-71. (Condensed from *Rev. appl. Mycol.*, **8**, pp. 751-2.)
Red currants showed reversion under conditions indicating spread from black currants; *Ribes sanguineum* was also affected. Marlboro, Superlative, Fajstrup resistant Asker, Non Plus Ultra, Summit of Perfection, and other raspberry varieties have been found susceptible to anthracnose (*Plectodiscella* [*Elsinoë*] *veneta*) which, though prevalent, is seldom severe in Denmark.

34. Anonymous. 1929. Survey of plant diseases. 166. August 1929. *Statens Plantepatologiske Forsøg*, 7 pp.
Red and black currants and gooseberries have been widely attacked by *Gloeosporium* (*Pseudopeziza*) *ribis*; the Red Spanish currant is resistant.

35. Anonymous. 1930. Plant breeding at the Connecticut State Station. *Bull. Conn. agric. Exp. Sta.*, **318**, p. 760.
Black raspberries showed no inbreeding depression after two generations of selfing, and seedlings were free from mosaic.

36. Anonymous. 1930. Plant pathology at the New York State Station. *Rep. N.Y. St. agric. Exp. Sta.*, **49**, pp. 40-7. (Condensed from *Exp. Sta. Rec.*, **64**, pp. 447-8.)
Yellow mosaic spread more slowly in Plum Farmer and Cumberland than did red raspberry mosaic, but quickly killed the affected plants. Mild streak spread very slowly in Plum Farmer and Cumberland and rapidly in Ohio.

When crossed with Newman and Herbert, Cuthbert contributed susceptibility to yellow mosaic. June also transmitted susceptibility in crosses with Herbert. Seedlings of Herbert × Newman showed resistance to yellow mosaic; in one cross, 12 seedlings were free, 1 resistant, and 1 susceptible. Of 42 seedlings with Newman as a parent, 86% were free from yellow mosaic after three seasons, whereas only 56% of 25 seedlings with Cuthbert as a parent were free.

37. Anonymous. 1931. Plant breeding at the Connecticut Station. *Bull. Conn. agric. Exp. Sta.*, **322**, pp. 130-3.
Black raspberries grown from seed were found to be uniform in plant and fruit characters and free from mosaic.

38. Anonymous. 1931. Plant pathology at the New York State Station. *Rep. N.Y. St. agric. Exp. Sta.*, **50**, pp. 29-35. (Condensed from *Exp. Sta. Rec.*, **66**, pp. 543-4.)
One unnamed seedling black raspberry was found highly klendusic (disease escaping) but very susceptible to red mosaic. In a stand of some 130 plants, only one showed the disease in a three-year period, whereas the adjacent Dundee variety showed a high percentage of red mosaic. Among red raspberry seedlings, the progeny of Newman × Herbert was outstanding in klendusity or immunity and resistance to both yellow and red mosaic.

39. Anonymous. 1932. Division of botany. *Rep. N.Y. St. agric. Exp. Sta.*, **51,** pp. 31-43.

Naples black raspberry is markedly klendusic to red mosaic, but when infected shows very pronounced symptoms. Newburgh maintains high resistance to both red and yellow mosaic.

40. Anonymous. 1934. (The plant resources of the world as initial material in plant breeding. Botanic-ecological and economic characteristics. No. V. Fruits and small fruits and their wild relatives.) Lenin Acad. Agric. Sci., Inst. Plant Ind., Leningrad, 127 pp. (Condensed from *Plant Breed. Abstr.*, **5,** pp. 250-2.)

Raspberries and blackberries: 232 cultivated and 200 wild forms have been collected. Thirty-five varieties, selected for breeding purposes, are described. They are divided into frost-resistant, drought-resistant types, varieties with firm upright stems not requiring stakes, varieties with few spines, large fruits, high quality, late, early, and ever-bearing varieties. Types of special value in breeding are indicated, e.g. strong upright stems with sparse weak spines in *R. idaeus* var. *strigosus* Michx. and large fine-flavoured fruits in *R. idaeus* var. *vulgatus* Arrhen.

Currants and gooseberries: 366 cultivated, 265 wild and 126 hybrid varieties are growing. The most promising varieties for parents are indicated. The Altai species, *Grossularia acicularis* (Smith) Spach., although a poor cropper with small fruit, is of interest for breeding as it combines good flavour and early maturity with resistance to *Sphaerotheca* and to frost, and is better in this respect than the American species resistant to *Sphaerotheca*. It will need improving in habit, in spinelessness, and in the strength of the shoots. The American species are valuable for their tolerance of unfavourable conditions and of *Sphaerotheca*, frost and drought, and for their vigour, size, compact growth, and, in one case, spinelessness. Interspecific hybridization holds most promise in gooseberry breeding. Fortunately resistance to both *Sphaerotheca* and frost are combined in most of the promising species. Crosses of the large-fruited European with the Altai gooseberry give valuable forms with well-flavoured fruit even in F_1, whereas the F_1s of European × American species are very deficient in this respect. The best European varieties, being more or less resistant to *Sphaerotheca* and early maturing, are Grüne Flaschenbeere, May Duke, Maurer's Seedling, and Industry. *G. oxyacanthoides* L. is a most promising parent for spinelessness, also the French spineless varieties. Backcrossing will probably be necessary to increase the size of fruit.

Red currants: The Manchurian species *R. warscewiczii* Jancz. is an extremely high yielding, late type with sweet, dark red fruits of above average size. They are high in acid content, 3·86%, and low in sugar, 4·90%. The bush is strong, tall, compact, and resistant to anthracnose. *R. manshuricum* Komas. and *R. multiflorum* Kitt. have dense, long, many-flowered inflorescences, and flower very late. Their fruits are red and acid.

The main objectives in breeding small fruits are frost and drought resistance, extension of season and the production of autumn-fruiting raspberries for southern regions.

41. Anonymous. 1934. Division of botany. *Rep. N.Y. St. agric. Exp. Sta.*, **52,** pp. 27-42. (Condensed from *Rev. appl. Mycol.*, **13,** pp. 357-8.)

Cuthbert contributes susceptibility to red mosaic more than any other

parent tried in these 4-year studies. June and Marlboro also contributed susceptibility. Progeny of these three varieties showed a lack of klendusity to red mosaic, while Newman-Herbert crosses showed high klendusity. Mosaic-free stocks of the resistant red variety Latham and the black variety Cumberland, and trial plantings of the new mosaic-escaping red variety Newburgh are recommended. Columbian is resistant to red mosaic, showing only mild mottling.

42. Anonymous. 1934. Division of botany. *Rep. N.Y. St. agric. Exp. Sta.*, **53,** pp. 24-32.
The Columbian purple raspberry is resistant to red raspberry mosaic, showing only mild symptoms. Naples is highly resistant to *Elsinoë veneta*; Quillen, practically unaffected in Indiana, has not been tested at Geneva.

43. Anonymous. 1935. Division of botany. *Rep. N.Y. St. agric. Exp. Sta.*, **54,** pp. 30-6.
Under western New York conditions, the Potomac purple raspberry escapes green mottle mosaic (formerly called red raspberry mosaic) exceptionally well for a purple raspberry, but its fruit is inferior to that of Columbian.

44. Anonymous. 1935. Taylor, a new red raspberry. *Horticulture*, **13,** p. 407. (Condensed from *Plant Breed. Abstr.*, **6,** p. 194.)
Taylor, from Lloyd George × Newman, possesses the large size and regular long conical shape of the former combined with the firmness and light colour of the latter. It is slightly earlier than Latham which it surpasses in quality, being nearly equal to Cuthbert in this respect.

45. Anonymous. 1936. Division of horticulture. *Rep. Wash. St. agric. Exp. Sta., Bull.* **342,** pp. 43-9.
Work by C. D. Schwartze and G. A. Huber is reported. A proportion of hybrids from crosses of plants resistant to *Amphorophora rubi* with susceptible plants were found to be resistant. In several cases the resistance appeared to be equivalent to immunity under field conditions.
In experiments on the identity of the virus causing tip killing, certain black raspberries appeared somewhat resistant.

46. Anonymous. 1936. Physiological studies with virus infected raspberries. *Rep. Mich. agric. Exp. Sta.*, p. 20.
The total amounts of carbohydrates in the leaves of healthy and mosaic infected red raspberries are about equal, but the proportions are different, the diseased foliage containing about half as much glucose and three times as much sucrose as the healthy, and considerably less starch, which occurs mostly in the form of amylopectin in the healthy and of amylodextrin in the diseased plants.

47. Anonymous. 1937. (Notes.) *Bull. Lenin Acad. agric. Sci.* No. 3, p. 42. (Condensed from *Plant Breed. Abstr.*, **8,** p. 189.)
Various races of blackberry ($2n=28$) have been crossed with European raspberries ($2n=14$). When northern races of bramble were used, the F_1 plants ($2n=21$) were vigorous but only rarely set a single seed in some of the flowers. In F_2, plants of $2n=42$, 35 and 28 arose by chromosome reduplication, and these set fruit. The best yielders ($2n=35$) are undergoing field trials.

48. Anonymous. 1938. Williams develops new hybrid berries. *Ext. Fm. News N.C. Coll. Agric.*, **24** (2), p. 1.
The Dixie red raspberry was bred by C. F. Williams from a cross of an Asiatic species with Latham. It is suited to the sandhills and the eastern part of California where the cultivation of Latham itself is rendered impossible by high soil temperatures.

The Cameron dewberry, also bred by Williams, from the cross Lucretia × Young, largely combines the good flavour of Young with the firmness and transportability of Lucretia. It is resistant to leaf spot diseases.

49. Anonymous. 1938. Hybridization of black raspberries to obtain variety immune to anthracnose. *Rep. Ia agric. Exp. Sta., Pt I*, p. 173.
Black Pearl and Quillen hybrids were rather severely infected with anthracnose, but in no case was the infection as severe as on standard varieties such as Gregg and Cumberland. Resistance in black raspberries appears to be largely relative and it may be affected by cultural conditions as much as parentage. In general, younger plants seem more resistant than older ones.

50. Anonymous. 1938. Division of plant pathology. *Rep. N.Y. St. agric. Exp. Sta.*, **57**, pp. 22-4.
In tests of resistance to raspberry mosaic, Marcy, Indian Summer, and 20 seedling red raspberry varieties remained free from the disease.

51. Anonymous. 1938. Plant pathology. *Rep. Wash. St. agric. Exp. Sta.*, being *Bull.* **368,** pp. 59-67.
In trial plantings of Newburgh, Lloyd George, Taylor, Marcy, Indian Summer, and Latham, the last named became infected with mosaic, while the others remained healthy. In one locality, Newburgh remained virus free though growing beside infected Cuthbert raspberries for four years.

52. Anonymous. 1938. Pomology department. *Rep. John Innes hort. Instn for 1937*, pp. 12-15.
Rubus vitifolius [*R. ursinus*] (2n=56) × tetraploid raspberry (2n=28) gave a family in which about half the plants were hexaploid (2n=42) and resembled the loganberry. The remainder of the seedlings resembled *R. vitifolius*.

A promising seedling has been selected from among the F_3 thornless progeny of the cross *R. rusticanus inermis* × *R. thyrsiger*; this is to be released commercially.

53. Anonymous. 1939. Pomology department. *Rep. John Innes hort. Instn for 1938*, pp. 11-15.
Diploid blackberry species appear always to reproduce sexually but in polyploid forms and species reproduction may be entirely sexual, apomictic, or partly sexual and partly apomictic. Segregation occurs within non-sexual offspring and has given new types which breed true, e.g. a species with small flowers and 5-leaflet leaves has given a form with large flowers and 7-leaflet leaves. Similarly a dioecious species has given male and female forms in the apomictic progeny. Evidently the apomictic embryo arises after the first division of meiosis.

Further work has substantiated earlier conclusions as to the hybrid origin of the loganberry.

In raspberries D. Lewis has found a gene which inhibits pollen tube growth. Further evidence has been obtained for the regression of HH (hairy) forms by a closely linked lethal. Backcrosses give normal 1: 1 ratios of hairy to subglabrous, whereas F_2 ratios approximate to 2: 1 instead of 3: 1.

54. Anonymous. 1939. Hybridization of black raspberries to obtain a variety immune to anthracnose. *Rep. Ia agric. Exp. Sta., Pt I,* p. 185.

Rubus parvifolius is hardy and apparently very resistant to the diseases which ordinarily infect raspberries in Iowa. It has been crossed with a number of red, black, and purple varieties. *R. coreanus*, which is reported as being anthracnose resistant, will also be used.

55. Anonymous. 1940. Pomology report. *Rep. John Innes hort. Instn for 1939*, pp. 3-5.

Some species of blackberries are purely sexual, others are facultative apomicts or versatile in their methods of reproduction.

P. T. Thomas has found that *Rubus* species which fail to reproduce sexually do so because of chromosome behaviour. These species include all triploids, and those tetraploids and hexaploids which are undifferentiated autopolyploids. The purely sexual species are the diploids and the allotetraploids and allohexaploids.

In raspberries, triploids occur among the progeny of diploids in the proportion of *c.* 1 in 400. These triploids when selfed give a high proportion of tetraploid offspring, which in fertility and all other respects resemble the established tetraploid varieties.

56. Anonymous. 1941. *Rep. Tenn. agric. Exp. Sta.*, **54,** 100 pp.

All raspberry crosses involving Preussen were susceptible to leaf spot. Sib-crosses carrying one-eighth *Rubus kuntzeanus* are showing good commercial quality.

57. Anonymous. 1941. *Rep. R.I. agric. Exp. Sta.*, **53,** being *Contr.* **586,** 71 pp.

The Austin Thornless blackberry is cross and self fertile and transmits thornlessness.

58. Anonymous. 1942. Research work and workers. *Seed World*, **52,** No. 12, p. 44.

Milton is described as a late red raspberry with large berries resembling those of Taylor; it is very resistant to mosaic.

59. Anonymous. 1942. Report on agricultural research for the year ending June 30 1942. *Rep. Ia Corn Res. Inst.*, **7,** *Pt I*, 293 pp.

Three varieties of black raspberries (Nos. 20, 51, and 77) have been selected from the cross Black Pearl × Quillen. They are winter hardy and anthracnose resistant; the first two are late and the third is early.

60. Anonymous. 1943. 53rd Annual report of the Washington State Agricultural Experiment Station for the year ended June 30 1943. *Bull. Wash. St. agric. Exp. Sta.*, **435,** 163 pp.

Brainerd and WSC 1 (Brainerd × Evergreen hybrid) were outstanding for their lack of winter injury under the severe conditions of 1942-3.

61. Anonymous. 1944. Hybridization of black raspberries to secure variety immune to anthracnose. *Rep. Ia agric. Exp. Sta., Pt I*, p. 228.
Red and black raspberry varieties are being crossed with *Rubus coreanus* (resistant to anthracnose); also standard varieties are being crossed with a thornless species of *Rubus* which appears resistant to all fungal diseases of stem and leaf.

62. Anonymous. 1944. Agricultural research in New Hampshire. *Rep. N.H. agric. Exp. Sta.*, being *Bull.* **354**, 68 pp.
The wild thornless blackberry (*Rubus canadensis*) has been crossed with cultivated varieties to obtain hardy thornless varieties. *R. odoratus* has been crossed with both raspberries and blackberries.

63. Anonymous. 1944. *Rep. Tenn. agric. Exp. Sta.*, **57,** 107 pp.
Crosses have been made between *R. macrocarpus* and Eldorado, Himalaya, and other blackberry varieties.

64. Anonymous. 1945. Thornless gooseberries. *Gdnrs' Chron.*, **118,** p. 125. (From *Plant Breed. Abstr.*, **16,** p. 21.)
Work at the Central Experimental Farm, Ottawa, is described. A back-cross seedling of the hybrid between the thornless species *Ribes oxyacanthoides*, and a commercial gooseberry, was thornless and bore fruits of commercial size, and was named Spinefree. It was, however, found to be a variable cropper with somewhat small fruits. Spinefree was crossed with the large-fruited variety Clark. Thornless seedlings with fruits of commercial size from this cross, designated 0-271, 0-274 and 0-275, are under test in Canada.

65. Anonymous. 1945. 55th Annual report of the Washington State Agricultural Experiment Station for the year ended June 30 1945, being *Bull. Wash. St. agric. Exp. Sta.*, **470,** 167 pp.
Taylor raspberry transmits large berry size to hybrid seedlings but is inferior to Cuthbert and Washington in transmitting good flavour. Failure of *Amphorophora rubi* to feed on Lloyd George, Washington and Tahoma enables these varieties to escape mosaic. Many hybrids resistant to *A. rubi* have been developed. Certain selections were found to be homozygous for resistance.

Two biologic races of yellow rust exist: Washington is resistant to one of these.

66. Anonymous. 1945. Hybridization of black raspberries to secure varieties immune to anthracnose. *Rep. Ia agric. Exp. Sta., Pt I*, p. 296.
Rubus parvifolius, *R. coreanus* and *R. rusticanus* PI-131870 are resistant to anthracnose—the last named being apparently resistant to all types of insect and disease infestation on stem and foliage. These species are being used in crossing with red, black, and purple raspberries. Some F_2 seedlings from a cross of *R. parvifolius* and red raspberry show considerable improvement in fruit characters and in hardiness.

67. Anonymous. 1945. Agricultural research in New Hampshire. *Rep. N.H. agric. Exp. Sta.*, being *Bull.* **363,** 61 pp.
Hybrids between blackberry and *R. odoratus* were thornless, pink flowered and almost sterile. Root cuttings treated with colchicine gave several apparently tetraploid plants.

68. Anonymous. 1946. *Rep. Ky agric. Exp. Sta.*, **59,** 68 pp.
The blackberry variety Alfred was virtually eliminated by orange rust.

69. Anonymous. 1946. Small fruits. *Rep. Wash. St. agric. Exp. Sta.*, being *Bull.* **482,** pp. 54-62.
The green aphid vector of mosaic refuses to feed on Washington, Tahoma, and Lloyd George and these varieties do not contract mosaic. There are at least two strains of western yellow rust of raspberries, Washington is resistant to one of them. Latham and Tahoma are resistant to both.

The Thornless Boysenberry was superior in growth and yield to all other dewberries and was the only dewberry not seriously damaged by cane die-back. This was attributed to the lack of thorns which cause serious damage to canes in handling. Cane blight caused heavy damage to Evergreen blackberry.

70. Anonymous. 1947. State news. Texas. *Amer. Fruit Gr*, **67** (7), p. 27. (Condensed from *Plant Breed. Abstr.*, **17,** p. 336.)
Notes are given on Earli-Ness (R40-4), Big-Ness (R40-51) and Regal-Ness (R40-202), new varieties developed by backcrossing the Nessberry to the wild dewberry. In 1946, Earli-Ness began to ripen on 18 April. Big-Ness bears large fruit and is early maturing, but the fruit is too soft for transport. Regal-Ness crops about a week later than Earli-Ness, which it otherwise resembles.

71. Anonymous. 1947. Nationwide fruits. Raspberries. *Amer. Fruit Gr*, **67** (11), pp. 16-17. (Condensed from *Plant Breed. Abstr.*, **18,** p. 366.)
The raspberry variety September was developed by New York Agricultural Experiment Station from a cross between Marcy and Ranere. The fruit is medium sized, firm, and bright red. The variety produces a high quality autumn crop ripening 2-4 weeks earlier than Indian Summer; its summer crop is as early as Indian Summer. September does not plug completely easily.

72. Anonymous. 1947. *Sixteenth Annual Report of the Minister for Agriculture, Eire, 1946-47*, p.12.
The gooseberry variety Keepsake has shown relative resistance to *Sphaerotheca mors-uvae.*

73. Anonymous. 1948. New blackberry. *Amer. Nurserym.*, **88** (5), p. 47. (Condensed from *Plant Breed. Abstr.*, **19,** p. 156.)
The Chehalem blackberry was developed at the Oregon State College Experiment Station from a cross between Santiam and Himalaya. Its bright black fruit is especially suitable for freezing, the colour being retained both in freezing and canning. Its flavour, resembling that of the native trailing berry, is also retained in freezing but is partly lost in canning. The fruit starts to ripen 5-10 days after Boysen and continues until Evergreen begins to ripen.

74. Anonymous. 1948. Research and experimental work. Variety trials—Canning—Quick freezing. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 10-11.
Canning: Raspberries—Malling M and J [Jewel] were slightly better than Norfolk Giant. Promise and Landmark were rather unsatisfactory, the latter having a pale colour and weak flavour.

Quick freezing: Raspberries—Norfolk Giant, Malling J and Malling M gave the best results. Enterprise was next in order of merit, followed by Malling G, K, Promise, and Landmark.

75. Anonymous. 1949. Research and farming. *Seventy-first Rep. N.C. agric. Exp. Sta. 1948*, 7 (4), 68 pp. (Condensed from *Plant Breed. Abstr.*, **20,** pp. 667-8.)

A world-wide collection of *Rubus* species is being used in raspberry breeding. The fourth generation of Latham × *R. biflorus* fruited for the first time; vigour, productivity, and disease resistance of these fourth generation hybrids are very satisfactory.

76. Anonymous. 1949. Canning and quick-freezing trials. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 15-18.

Canning: Raspberries—Malling J [Jewel] gave very good results, Promise was only moderate and Landmark poor. None equalled Norfolk Giant or Lloyd George.

77. Anonymous. 1949. *Sixty-second Rep. Tenn. agric. Exp. Sta.*, 177 pp. (Condensed from *Plant Breed. Abstr.*, **21,** pp. 799-800.)

Seeds have been obtained of crosses between Eldorado, Alfred, Latham, Royal, Latham × *R. parviflorus*, and Bedford Giant as female parents with *R. macrocarpus*. Seed of *R. glaucus* has been introduced.

78. Anonymous. 1950. West coast blackberry. *Amer. Nurserym.*, **91** (10), p. 41.

The blackberry Olallie, from Black Logan × Youngberry, retains its bright black colour and firm texture in canning and freezing. It is a vigorous trailing type with berries nearly as large as Boysenberry.

79. Anonymous. 1950. *Report of the Minister of Agriculture for Canada for the year ended March 31, 1950*, 287 pp. (Condensed from *Plant Breed. Abstr.*, **21,** pp. 535-9.)

Raspberry.—The new hybrid raspberries Tweed, Trent, Muskoka, and Madawaska have outyielded standard varieties during a 5-year period. Muskoka is the hardiest variety fruiting at Ottawa and responds well to winter conditions in the Prairie Provinces.

Currants.—The rust-resistant black currants Crusader and Coronet have been found to be incapable of pollinating each other, though fruit is formed following hand pollination. Crusader pollen tends to stick together in clumps and bees do not easily pick it up. The flowers of Coronet do not open widely at the top so that bees often reach in from the side of the flower without contacting the anthers. A third rust-resistant selection, 0-396 [Consort], is cross compatible with Crusader and Coronet and is able to pollinate itself without the aid of insects. It is at least equal to Crusader and Coronet in yield and other characters. Viking and *Ribes diacanthum* have been used in breeding for resistance to rust and aphids in red currants. One seedling from Viking × Stephens 9 is immune to rust and highly resistant to aphids.

Gooseberry.—The thornless variety 0-272 has been named Captivator. Its berries are red and equal in size to those of Poorman.

80. Anonymous. 1950. (Variety trials with raspberries 1938-48.) *Tidsskr. Planteavl*, **54,** pp. 152-5. (Condensed from *Plant Breed. Abstr.*, **21,** p. 675.)
Spangsbjerg 140 (Fajstrup × Marlborough 1925) and Spangsbjerg 8 (Fajstrup × Lloyd George 1929) were outyielded by Preussen and Lloyd George at experiment stations in Denmark.

81. Anonymous. 1950. Berries for home use. *Amer. Nurserym.*, **102** (10), pp. 65-6.
The raspberry Amber, from a cross between Taylor and Cuthbert, ripens late and has large yellowish-orange, sweet fruits. The variety has shown little winter injury.

82. Anonymous. 1950. Research and farming. *Seventy-second Rep. N.C. agric. Exp. Sta. 1949*, **8** (4), 68 pp. (Condensed from *Plant Breed. Abstr.*, **22,** pp. 206-7.)
The release of 40-7-6, a vigorous raspberry from the F_2 of a cross between *Rubus parvifolius* and an American cultivated raspberry, is reported. The new variety is well adapted to eastern North Carolina where it resists common diseases and yields well. A dewberry selection, 38-7-3, from Austin Thornless × Lucretia is more vigorous and disease resistant than Lucretia.

83, Anonymous. 1950. *Sixty-third Annual Report of the University of Tennessee Agricultural Experiment Station for 1950*, 149 pp. (Condensed from *Plant Breed. Abstr.*, **23,** pp. 221-2.)
Two African *Rubus* spp. resistant to anthracnose were crossed with American varieties of black raspberries. Good pollination has been obtained with Early King on Boysenberry and Dallas, Ozark Beauty on Early King and Dallas, and with Dallas on Boysenberry.

84. Anonymous. 1950. *Progress Report 1934-1948. Division of Horticulture, Central Experimental Farm, Ottawa.* 259 pp. (Condensed from *Rev. appl. Mycol.*, **30,** pp. 15-17.)
Chief, Cuthbert, Latham, and Ottawa were the most severely affected by mosaic; Herbert, Indian Summer, Madawaska, Marcy, Milton, Tahoma, Trent, and Washington showed no mosaic.

Late yellow rust, *Pucciniastrum americanum*, was most severe on Ottawa. Viking, a parent of Ottawa, was moderately susceptible and five out of ten seedlings with Viking ancestry showed some degree of susceptibility. Gatineau, Rideau, Taylor, Trent, and Washington were moderately susceptible to leaf spot (*Septoria rubi*). Ottawa is quite susceptible to powdery mildew (*Sphaerotheca humuli*). All Lloyd George × Newman 23 hybrids, including Gatineau, Madawaska, Marcy, Rideau, Taylor, and Trent, were moderately to highly susceptible to anthracnose (*Elsinoë veneta*). Washington was the most susceptible variety; Tahoma was only moderately affected. Chief, Latham, Monroe, Newburgh, Newman 23, Ottawa, and Viking showed only slight infection. Madawaska, Rideau, and Taylor were the most susceptible to spur blight (*Didymella applanata*), other varieties of similar parentage such as Gatineau and Marcy were only slightly to moderately susceptible.

In 1945 a yield trial was laid down at Ottawa consisting of ten black currant selections resistant to *Cronartium ribicola*. On the basis of the first full crop harvested in 1948, Crusader and Coronet were two of the

highest yielding rustless varieties, equalling Climax and Magnus but being slightly less productive than Kerry and Saunders.

Viking was crossed with Cascade, Red Lake, and Stephens No. 9; all the F_1s which have fruited to date are resistant to *Cronartium*.

85. Anonymous. 1950. Canning and quick freezing trials. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 10-16.

Canning: Raspberries.—The best variety tested was New Zealand Lloyd George. St. Walfried was good but rather soft. Norfolk Giant was good, Jewel fairly satisfactory, and Promise and Landmark poor.

Gooseberries.—The best variety was Howard's Lancer. Green Gem and Ingall's Prolific Red were unsatisfactory for colour.

Blackberries.—Bedford Giant was better than Black Diamond and Himalayan Giant.

Black currants.—Cotswold Cross and Malvern Cross were both very good and of fine flavour; Laxton's Giant and Wellington XXX were good; Blacksmith was fairly good. The flavour of Mendip Cross was rather acid and harsh.

Quick freezing: Raspberries.—Of the samples frozen in syrup, the best varieties were St. Walfried, New Zealand Lloyd George, Enterprise and Norfolk Giant; of those frozen in sugar, Norfolk Giant, Malling X [Exploit], Lloyd George and St. Walfried were best. Malling J [Jewel], G. and K were moderate in both tests and Landmark and Promise were the poorest, as in several previous tests.

Gooseberries.—Howard's Lancer and Careless were best. Green Gem was fairly good. Ingall's Prolific Red and Leveller were unsatisfactory for colour.

Blackberries.—Black Diamond [probably not Evergreen, *see* Abstr. 129] and Bedford Giant were both very satisfactory.

Black currants.—The best were Laxton's Giant and Cotswold Cross. Malvern Cross, Wellington XXX and Blacksmith were very satisfactory. Mendip Cross was the poorest.

86. Anonymous. 1951. *Annual Report of the Director, Experimental Farms Service, Dep. Agric. Canada, 1949-1950*, 87 pp. (Condensed from *Rev. appl. Mycol.*, **30**, pp. 507-8.)

The black currant varieties Crusader and Coronet, immune from rust (*Cronartium ribicola*), are under most conditions unable to pollinate themselves or one another. Rustless selection No. 0-396 [Consort] is, however, a free pollen producer, will set fruit on both the foregoing, is self-pollinating, and is at least equal to them in yield and in all other respects.

Viking and *Ribes diacanthum* are being used in breeding for resistance to rust and aphids in red currants. One seedling from Viking × Stephens No. 9 is completely resistant to rust and highly resistant to aphids.

87. Anonymous. 1951. Bush fruits. *Bull. Minist. Agric., Lond.*, **4**, 36 pp.

Descriptions are given of red and black currant and gooseberry varieties.

88. Anonymous. 1951. New early berry. *Amer. Fruit Gr*, **71** (12), p. 22.

Describes the red raspberry, Early Red, derived from Lloyd George × Cuthbert.

89. Anonymous. 1951. Research leads the way to agricultural progress. *Rep. Md agric. Exp. Sta.*, being *Bull.* **A-67,** 88 pp. (Condensed from *Plant Breed. Abstr.*, **23,** pp. 401-2.)

The early ripening red raspberry Antietum is to be released; it has withstood nine consecutive winters without injury.

90. Anonymous. 1951. Canning and quick freezing trials. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 10-15.

Canning: Raspberries.—St. Walfried gave the best results, Willamette was good while Jewel was the best of the Malling varieties. Exploit, Malling 51/85, Promise, and Malling G were all rather poor.

Gooseberries.—Varieties tested and results were the same as in the previous year.

Freezing: Raspberries.—Of the samples frozen in syrup the best were Lloyd George and Jewel, followed by Exploit and St. Walfried. Malling Seedling 51/85, Promise, and Malling G were all rather poor. The samples frozen in sugar gave variable results, depending on the origin of the samples tested, but Promise, Malling 51/85 and Malling G were all poor.

Gooseberries.—The best two varieties were Howard's Lancer and Careless. Ingall's Prolific Red frozen in the green state was very satisfactory but Green Gem was too acid.

91. Anonymous. 1952. Report of the Director of the New Hampshire Agricultural Experiment Station, July 1, 1949–June 30, 1951. *Bull. Univ. N.H.*, **394,** 48 pp. (Condensed from *Plant Breed. Abstr.*, **23,** p. 217.)

Korean Tree Berry, a selection of *Rubus morifolius*, shows marked winter hardiness and disease resistance. It is vigorous and productive, bearing translucent, glossy, sweet-flavoured berries. It has been crossed with red, black, and purple raspberries.

Two selections, 100 and 101, from Taylor × *R. chamaemorus* F_2 are to be distributed for trial, both have been outstanding for hardiness and yield.

92. Anonymous. 1952. Chromosome counts of species and varieties of garden plants. *Rep. John Innes hort. Instn for 1951*, pp. 47-50.

The following counts of *Rubus* spp., made by G. E. Marks, are given: *R. coreanus* 2n = 14, *gracilis* 14, *coutinhi* 28, *fuscus* 28, *omiensis* 28, *caprinifolius* 35, *drejeri* 35, *dumetorum* 35, *koehleri* 35, *lentiginosus* 35, *thyrsoideus* 35, *magnificus* 42.

93. Anonymous. 1953. New thornless raspberry. *Amer. Nurserym.*, **98** (4), p. 56. (From *Plant Breed. Abstr.*, **24,** p. 118.)

The thornless mid-season red raspberry Canby, developed at the Oregon Agricultural Experiment Station, is superior to other commercial varieties of the Pacific Northwest in ability to retain colour, firmness, and texture in storage and freezing.

94. Anonymous. 1953. Purple Autumn raspberry. *Amer. Nurserym.*, **98** (7), p. 65. (From *Plant Breed. Abstr.*, **24,** p. 281.)

Purple Autumn, from a cross between Bristol and Indian Summer made at the Illinois Agricultural Experiment Station, is a mid-season variety which has long fruits.

95. Anonymous. 1954. (*Annual Report for 1951-1952.*) *Inst. Vered. Tuinb. Gewass*, 151 pp.
At Wageningen, crosses have been made between Bath's Perfection, Malling Landmark, Roodstekelige (Red Spined), and Superlative geel (Superlative yellow), all of which have shown some resistance to *Amphorophora rubi*.

96. Anonymous. 1954. (Breeding for resistance in fruit: (*c*) berry fruits.) *Saatgutwirtschaft*, **6**, p. 206. (From *Plant Breed. Abstr.*, **25**, p. 84.)
A general account of breeding for disease resistance in soft fruits is given. American varieties of raspberry and blackberry may provide material for breeding for resistance to *Didymella applanata* and *Leptosphaeria coniothyrium*, while the American varieties Philadelphia and Eldorado should prove useful for breeding for frost resistance in German blackberries. *Sphaerotheca mors-uvae* is the most serious disease attacking the gooseberry; American varieties resistant to the fungus have been developed. Leaf shedding in black and red currants may be combated by crossing susceptible varieties with strains containing genes from *Ribes alpinum*.

97. Anonymous. 1954. List resistant berries. *Amer. Nurserym.*, **99** (7), p. 34.
Of the trailing blackberry varieties tested at the University of California, Cascade, Chehalem, Himalaya, Logan, and Oilalie showed most resistance to *Verticillium* wilt and produced high yields.

98. Anonymous. 1954. Report on research work. Variety trials: Canning, quick freezing. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 11-12.
Canning: Of the ten varieties of raspberries tested, Lloyd George, Norfolk Giant, St. Walfried and Malling V were placed top in that order.
Quick freezing: The best of the nine varieties of raspberries frozen in syrup were two lots of Malling V; Norfolk Giant was third.

99. Anonymous. 1955. Hungarians claim new apple and loganberry. *Comm. Gr*, p. 206.
Hybridization of different varieties of raspberries and wild blackberries resulted in a loganberry with dark-purple, almost black fruits. It is suitable for preserving and travels well. It is more acid, palatable, and frost hardy than the raspberry, and the fruits are three to five times as large with a high vitamin content.

100. Anonymous. 1955. Report on research work. Variety trials: quick freezing. *Rep. Fruit Veg. Pres. Sta., Campden*, p. 13.
Malling V, from two districts, was again top of the raspberry varieties, with Enterprise second. Jewel was satisfactory, except for its flavour.

101. Anonymous. 1955. (A new blackberry: Colombia Giant.) *Fruitteelt*, **45**, p. 960.
A brief description of the Giant Colombian blackberry.

102. Anonymous. 1955. Goudbal. *Fruitteelt*, **45**, p. 952.
The gooseberry variety Goudbal (Golden Ball) developed at Noordbrock Research Station, Netherlands, has large glabrous yellow berries suitable for preserving and dessert.

103. Anonymous. 1955. Cane fruits. *Bull. Minist. Agric., Lond.*, **156,** 29 pp. Raspberry, blackberry and loganberry varieties are briefly described and notes on their disease response are included.

104. Anthony, R. D. 1916. Some notes on the breeding of raspberries. *Bull. N.Y. agric. Exp. Sta.*, **417,** pp. 75-88.

June, from Loudon \ Marlboro, and Marldon (from the reciprocal) are promising early varieties. Louboro and Donboro derive from Loudon × Marlboro, and Marlative is from Marlboro \ Superlative. The purple varieties Columbian and Shaffie arose as chance hybrids.

Marlboro has been widely used in crosses—in general its seedlings are early (frequently earlier than the parent), with fruit of good size, sometimes rather soft, and often lacking in quality. A low proportion of yellow seedlings occurs, and a few spineless plants have appeared in several of its crosses. June is nearly spineless. Marlboro \ June gave 27 plants spineless or with only a few spines at the base of the canes; 28 with spines only on the leaf midribs; 4 with few spines; and 4 with a medium amount on the canes.

Herbert selfs lack vigour and about 50% died in their first year. Those plants which fruited had large conical berries some of which were too soft. One yellow seedling was found out of the original 35 plants.

Crosses of Cumberland with Palmer and Hilborn blackcaps and with June have given yellow seedlings, but the proportion in the inter-black crosses indicated several pairs of colour factors. June \ Cuthbert gave 60 red: 2 yellow; Marlboro × June gave 66: 4; and Herbert selfed gave 55: 1. Columbian selfed gave 31 purple: 7 wine red: 2 doubtful reds: 1 yellow: 1 black. A black which is pure for colour produces only purples when crossed with red, even when the red carries the yellow factor. Cumberland × June gave 165 purples: 8 yellows.

Columbian selfed gave a 3: 1 ratio of glaucous to non-glaucous canes. Cumberland × June and Smith No. 1 (black) \ June gave 3: 1 ratios of glaucous to non-glaucous and of rough (exfoliated) bark to smooth. Cumberland seedlings consisted of 16 very spiny: 25 intermediate: 9 with very few spines. Cumberland / June gave 46 dwarfs with shortened internodes and 178 normals.

Rubus odoratus crossed readily with Herbert as male but less readily when Herbert was the female. The F_1s were slightly fertile. *R. odoratus* × Blowers blackberry gave 30 F_1 plants which all died in their first season.

105. Anthony, R. D. 1916. Some results in the breeding of small fruits. *Proc. Amer. Soc. hort. Sci.*, **12,** pp. 121-5.

Purple raspberries show near immunity to anthracnose, which is severe on blackcaps.

Columbian seedlings showed less segregation in F_2 than was expected, most characters being intermediate with very few cases where they approached closely to either parent.

Cumberland × June gave 280 purple: 9 yellow fruited plants. None of these seedlings, nor any of the Smith No. 1 (black) / June, produced suckers. Some of the fruits were dull, due to pubescence, others were shiny.

The Cumberland hybrids gave a proportion of dwarfs with shortened internodes (sometimes less than $\frac{1}{4}$ in.), small leaves, brittle petioles, and canes thickly covered with soft spines—normal plants had few but stiff spines. The dwarfs ranged up to 2 ft. in height. There were 178 normals:

46 dwarfs. The divergence from a 3: 1 expectation is attributed to higher mortality in the dwarfs.

In red raspberries, terminal leaves of young canes are tinged on the upper surface with red. Yellow raspberries, whether of red ancestry or from crosses between blacks and reds, lack this reddish tinge.

106. Babington, C. C. 1869. The British *Rubi.* John Van Voorst, London, 305 pp.

Bagenal, N. B. 1941. *See* **Beakbane, A. B.,** and **Bagenal, N. B.**

107. Bailey, J. S. 1948. A study of the rest period in red raspberries. *Proc. Amer. Soc. hort. Sci.*, **52,** pp. 265-70.

The rest period of red raspberries in Massachusetts normally ends in early December, the plants coming out of rest gradually. The ending of rest is brought about by the accumulation of hours of temperature below about 41° F. Periods of low temperature play a minor part in ending rest. Hardy varieties such as Chief and Latham enter a deeper rest and emerge more slowly than tender varieties such as Marcy and Washington. Chief is outstanding in its ability to enter deep rest and emerge slowly.

108. Bailey, J. S., French, A. P., and **Van Meter, R. A. 1944.** Nature of winter hardiness in the raspberry. *Bull. Mass. agric. Exp. Sta.*, **417,** pp. 58-9.

Shoots of six varieties of raspberry, Latham, Chief, Marcy, Taylor, Milton, and Washington, were forced at monthly intervals during the winter to determine the length of the rest period. This is very short, ending in late November for a tender variety like Marcy, and in early December for hardy varieties such as Latham and Chief.

The terminal buds of canes usually start first, this is due to polarity and not to differences in rest period.

Estimates were made in the spring of 1943 and 1944 of the amount of winter injury to red raspberries, expressed as percentage of total cane length injured:

Variety	*Percent injury*		*Variety*	*Percent injury*	
	1943	1944		1943	1944
Sunrise	0	10	Cuthbert	25	60
Tahoma	5	10	Taylor	28	13
Indian Summer ..	5	5	Washington ..	30	31
Latham	9	8	Ohta	35	15
Ranere	10	10	Milton	44	18
Lloyd George ..	15	40	Marcy	68	63
Chief	11	6	Viking	45	70
Cayuga	20	5	Newburgh ..	75	50

109. Bailey, L. H. 1923. Certain cultivated *Rubi. Gentes Herbarum*, **1** (4), pp. 139-200.

110. Bailey, L. H. 1925. *Rubus:* enumeration of the *Eubati* (dewberries and blackberries) native in North America. *Gentes Herbarum*, **1** (5), pp. 203-300.

111. Bailey, L. H. 1932. The blackberries of North America. *Gentes Herbarum*, **2** (6), pp. 269-423.

112. Bailey, L. H. 1932. Addenda in *Eubatus. Gentes Herbarum*, **2** (7), pp. 427-47.

113. Bailey, L. H. 1933. Blackberries of the Lower South. *Gentes Herbarum*, **3** (3), pp. 119-48.

114. Bailey, L. H. 1934. Certain northern blackberries. *Gentes Herbarum*, **3** (5), pp. 247-71.

115. Bailey, L. H. 1941-45. *Rubus* in North America. *Gentes Herbarum*, **5** (1-10), pp. 1-64, 201-918.

116. Bailey, L. H. 1944, Certain *Rubi* of the occidental tropics. *Gentes Herbarum*, **6** (6), pp. 325-64.

117. Bailey, L. H. 1947. Species studies in *Rubus*. *Gentes Herbarum*, **7** (3), pp. 193-349.

118. Bailey, L. H. 1949. *Rubus* studies—review and additions. *Gentes Herbarum*, **7** (6), pp. 481-526.

Baker, R. E. 1943. *See* **Wiggans, C. C.,** and **Baker, R. E.**

119. Baker, R. E. 1949. New blackberry. *Calif. Agric.*, **3** (4), pp. 11, 14-15. (Condensed from *Plant Breed. Abstr.*, **19,** p. 636.)

A Boysenberry with shiny fruit was first reported in commercial plantings of Boysenberries near Denair; it is probably a periclinal chimaera. Its fruit is smaller than that of Boysen and more rounded, the drupelets being less crowded on the core. The flavour is more attractive than Boysen; its picking season is the same. Descriptions are also given of the Youngberry, Rossberry, Thornless Boysen, Austin dewberry, Nectar, Texas Everbearer and Alfred.

120. Baker, R. E., and **Butterfield, H. M. 1951.** Commercial bush berry growing in California. *Circ. Calif. agric. Ext. Serv.*, **169,** 50 pp. (Condensed from *Rev. appl. Mycol.*, **31,** pp. 23-4.)

Orange rust, *Gymnoconia interstitialis*, is troublesome in coastal districts, where the wild Pacific Coast blackberry is severely attacked. Crandall and Young are badly affected, loganberry less seriously, and Himalaya blackberry only slightly. Boysen remains unaffected even when Young plantings in the vicinity are badly diseased.

121. Banga, O. 1942. (The significance of the flower characters for the identification of red currant varieties.) *Fruitteelt*, **32,** pp. 187-94.

122. Barker, B. T. P., and **Spinks, G. T. 1919.** Fruit breeding investigations. *Rep. Long Ashton Res. Sta.*, pp. 76-84.

Crosses between Alexandra Autumnal raspberry, and Bath's Perfection, Harzuweil and Schaffer's Colossal gave about 10% of autumn fruiters. In the cross with Schaffer's Colossal, about 10% of the plants bore dark fruit like that of the male parent (Schaffer's) while 4 out of 60 of the Bath's Perfection crosses bore yellow fruit.

The F_1 of German Everbearing × loganberry and King's Acre berry proved almost sterile. Late summer and autumn fruiters appeared in the F_1 of German Everbearing × Superlative. November Abundance × Superlative gave an F_1 most of which were autumn fruiting.

Loganberry crossed with a number of raspberry varieties gave vigorous almost sterile plants. Loganberry × *Rubus biflorus* F_1 was quite sterile.

In selfs of loganberry, plants were obtained with fruit markedly less pubescent.

123. Bauer, R. 1938. (The method of mass infection in the breeding of varieties resistant to mildew and leaf fall in the genus *Ribes*.) *Forschungsdienst*, **6,** pp. 575-84. (From *Plant Breed. Abstr.*, **9,** p. 241.)

A technique for the artificial inoculation of seedlings of *Ribes* with spores of *Sphaerotheca mors-uvae* and *Gloeosporium ribis* is described. A suspension of spores is sprayed onto the plants with an atomizer and allowed to dry. The plants are subsequently kept in the greenhouse at 18-22° C. for 24 hours in a saturated atmosphere; relative humidity is then reduced to 80-90%. Optimum conditions of infection for the two fungi are closely similar, so that a mixture of spores may be used and the two tests performed simultaneously.

Gloeosporium may be cultured on artificial media, but *Sphaerotheca*, an obligate parasite, is maintained through the autumn on *Ribes* plants which have been cut back so that they produce new shoots. In the winter, suitable host material may be obtained either by giving a low temperature shock to *Ribes* plants so that they grow without a winter period of dormancy, or by growing seedlings of *R. alpinum*.

124. Bauer, R. 1955. (Resistance problems in the genus *Ribes* and possibilities of their solution by making intra- and inter-sectional crosses.) *Rep. 14th int. hort. Congr.*, Scheveningen, pp. 685-96.

Numerous gooseberries, red currants and black currants were tested for resistance to *Sphaerotheca mors-uvae* (Schw.) Berk., to *Pseudopeziza ribis* Kleb. and to *Cronartium ribicola* Fisch. None proved resistant and in selfed progenies the range of susceptibility was somewhat increased.

Intra-sectional crosses of *R. grossularia* with mildew resistant selections of *R. divaricatum* gave mildew-free, large-fruited gooseberries after the third backcross. These plants were highly resistant to *Pseudopeziza*, *Mycosphaerella*, and *Cronartium*. The three best plants were released in 1953 under the names Resistenta, Perle von Muncheberg, and Robustenta. The cross *R. nigrum* × *R. dikuscha* gave a very variable F_1. Two selections combined *Pseudopeziza* and *Cronartium* resistance but the fruit was only medium sized and of an unpleasant flavour. All seedlings of this parentage showed increased winter frost hardiness, but no improvement in spring frost resistance.

Amongst inter-sectional crosses, gooseberry × black currant gave sterile hybrids differing widely in growth habit and in susceptibility to the three leaf spot fungi. Mildew free hybrids were obtained only from the use of resistant gooseberry selections. In red currant × black currant crosses, about a third of the F_1 of Heros × Goliath were extremely vigorous seedlings with the crop well distributed over the plant. Three out of the 40 seedlings from this cross combined resistance to *Sphaerotheca*, *Pseudopeziza*, and *Cronartium*, as did some seedlings from similar crosses involving Holländische Rote as the red currant parent. In all such crosses the F_1 seedlings showed greater winter frost hardiness than the black currant parent.

True breeding amphidiploids were obtained by treating terminal buds with 1% colchicine.

Two approaches to the problem of disease resistance are suggested: (*a*) crossing cultivated varieties with wild types from the same section,

followed by repeated backcrossing to restore fruit quality, and (*b*) crossing cultivated varieties from different sections followed by colchicine treatment to get fertile commercial types in one step.

Baur, K. E. 1936. *See* **Jones, L. K., and Baur, K. E.**

Baver, L. D. 1942. *See* **Schaub, I. O., and Baver, L. D.**

125. Beach, G. 1934. A preliminary study of the fruiting habit of the black raspberry—*Rubus occidentalis*. *Proc. Amer. Soc. hort. Sci.*, **30,** p. 268 (Abstr.).

126. Beakbane, A. B. 1933. Cultivated blackberries, dewberries and hybrid berries. *Rep. E. Malling Res. Sta. for 1932*, pp. 68-72.

The name 'loganberry' has been found to cover many different forms.

Phenomenal berry and Parsley Leaved berry proved susceptible to reversion. Sherlock Junior proved susceptible to *Septocyta ramealis*, and loganberries suffered considerable damage from cane spot, *Plectodiscella* [*Elsinoë*] *veneta*.

127. Beakbane, A. B. 1935. Blackberries and loganberries. *Cherries and Soft Fruits Conf. roy. hort. Soc. Lond.*, pp. 129-32.

128. Beakbane, A. B. 1939. Trials of loganberries, blackberries and hybrid berries at East Malling. *Sci. Hort.*, **7,** pp. 64-70, and *Rep. E. Malling Res. Sta. for 1938*, pp. 213-17.

Commercial loganberry stocks showed considerable admixture with inferior seedlings. A plant apparently identical with the original loganberry was selected and propagated vegetatively for distribution.

Phenomenal berry has larger fruits than loganberry and is less susceptible to cane spot, but it is highly susceptible to dwarf disease.

Beakbane, A. B. 1940. *See* **Harris, R. V., Beakbane, A. B., and Moore, M. H.**

129. Beakbane, A. B. 1941. Studies of cultivated varieties of *Rubus* and their hybrids. II. Description and selection of clonal races of some cultivated blackberries and hybrid berries, including loganberries. *J. Pomol.*, **18,** pp. 368-78.

A brief botanical description is given of the chief varieties of cultivated blackberries and hybrid berries. The origin and history are given of the Himalaya and Black Diamond* (selections from *Rubus procerus* and closely similar, if not identical, with each other), Parsley Leaved berry (*R. laciniatus*), Loganberry and Phenomenal berry (from *R. ursinus* × *R. idaeus*), and Laxtonberry (from Superlative raspberry × Loganberry). The selection of clonal races of these is described and figures from yield trials are included.

130. Beakbane, A. B. 1941. Studies of cultivated varieties of *Rubus* and their hybrids. III. A comparative trial of Loganberry and Phenomenal berry plants grown under different methods of training and spraying to control cane spot disease. *J. Pomol.*, **18,** pp. 379-93.

* Darrow (1937b) gives Black Diamond as a synonym of Evergreen or Parsley Leaved berry.

Loganberry proved far more susceptible to cane spot (*Elsinoë veneta*) than Phenomenal berry. Different methods of training affected the amount of infection, and spraying with colloidal copper reduced the attack.

131. Beakbane, A. B., and **Bagenal, N. B. 1941.** Some practical points in the growing of loganberries and blackberries. *Rep. E. Malling Res. Sta. for 1940*, pp. 89-91.
Work on the identification and classification of loganberries, blackberries, and hybrid berries is described. Attention is drawn to botanical characters used to differentiate commercial varieties.

132. Bean, W. J. 1914. Garden notes on new trees and shrubs. *Kew Bull.* No. 2, pp. 49-54.
Mention is made of a gooseberry-black currant hybrid growing at Kew.

133. Beijerinck, W., and **Ter Pelkwijk, A. J. 1952.** *Rubi* in the north-eastern part of the Netherlands. *Acta bot. neerl.*, **1**, pp. 325-60.

134. Beijerinck, W. 1953. On the habit, ecology and taxonomy of the brambles of the Netherlands. *Acta bot. neerl.*, **1**, pp. 523-45.

135. Benedict, H. G. 1939. The Boysenberry without thorns, an early ripener. *Market Grs' J.*, **64**, p. 154.
A thornless bud sport of Boysenberry ripens three weeks earlier than the ordinary Boysenberry, which it otherwise resembles.

136. Bennett, C. W. 1927. Virus diseases of raspberries. *Tech. Bull. Mich. agric. Exp. Sta.*, **80**, 38 pp.
Five raspberry virus diseases are known in America: curl, red raspberry mosaic, mild mosaic, yellow mosaic and streak.

Curl, found on red, hybrid, and black raspberries, and on blackberry, is thought to involve only one virus. Cuthbert, Haymaker and Cumberland are very susceptible. The characteristic symptoms are curling of the leaves, deep green foliage, and general stunting. The disease is widely distributed in the U.S. and Canada.

Red raspberry mosaic occurs on red, hybrid, and black raspberries, and perhaps on blackberry and dewberry. It is by far the most common and destructive of the red raspberry viruses. Symptoms in red raspberries vary with variety from a mosaic mottle to yellow blotches on the leaves. Some wild *Rubus strigosus* plants may show no symptoms except on very young growth and very late growth. St. Regis and Sunbeam are tolerant. Symptoms on purple raspberries are similar to those on reds. Cardinal is very resistant. Black raspberries are rapidly killed, new canes in the season following infection being stunted and rosetted and dying back from the tip. Brownish splotches appear on the cane near the tip; mottling may or may not occur.

Mild mosaic occurs on black raspberries but the faint leaf-mottling is masked at high temperatures.

Yellow mosaic occurs on all leading black raspberry varieties; plants usually die in the second or third year following infection.

Streak attacks black raspberries, the symptoms resembling mild leaf curl. Stems of the new canes are striped or spotted with bluish-violet blotches and affected plants become progressively more stunted.

Aphis rubiphila was shown to transmit curl, while *Amphorophora rubi* transmits red, yellow, and mild mosaic. Transmission of curl from reds

to blacks has never been obtained and it is possible that two distinct curl viruses exist. Sap transmission of curl and red raspberry mosaic has been unsuccessful.

Curl virus was not transmitted through the eggs of viruliferous aphids to their progeny. Two hours feeding on an infected plant enabled *A. rubiphila* to transmit the virus to healthy plants. Curl virus persists in the aphid for a considerable period, probably for as long as it survives.

Red mosaic in red raspberries and purple cane hybrids and mild mosaic symptoms in black raspberry were more or less completely masked at 28° C.

Experiments to determine the movement of curl virus in plants showed that new canes developing from the roots soon after infection are usually themselves diseased. However, canes not infected but above the surface of the soil at the time of the inoculation remain healthy during the growing season. Next season, however, the whole plant usually shows curl. Where canes have been girdled below the point of inoculation, the rest of the plant has remained healthy.

Susceptibility to raspberry viruses, particularly red raspberry mosaic, varies widely between varieties, partly due to the habits of the vectors. Thus *A. rubiphila*, the curl vector, prefers Cuthbert to any other variety. This fact, plus extreme natural susceptibility, explains the high percentage of curl often found in this variety. Conversely, Cuthbert is somewhat resistant to *A. rubi* and remains relatively free from red raspberry mosaic.

Purple cane hybrids usually seem to be susceptible to the viruses of the red parent but immune or very resistant to those of the black.

137. Bennett, C. W. 1928. Diseases of fruit and nut crops in the United States in 1927. *Plant Dis. Reptr, Suppl.*, **60,** pp. 117-222.

Erskine Park, Sunbeam, Ohta, and St. Regis (Ranere) are very resistant to mosaic. Latham is highly susceptible to *Sphaerotheca humuli*, and Cardinal (purple) and Munger (black) are also susceptible.

138. Bennett, C. W. 1930. Further observations and experiments on the curl disease of raspberries. *Phytopathology*, **20,** pp. 787-802.

Curl virus has a general distribution in Cuthbert red raspberry in Michigan, but will not infect curl-susceptible Cumberland. The virus of curl from Cumberland black raspberry is transmissible to Cuthbert and can be transferred back to black. Two viruses are presumably involved. These have been designated respectively as alpha- and beta-curl virus.

The purple cane hybrid, Columbian, shows marked symptoms of curl when attacked by the beta virus and mild symptoms when infected by the alpha virus. Plants attacked by the alpha virus remain susceptible to infection by the beta virus.

Columbian plants infected by the alpha virus recover completely after a variable period, but remain subject to infection by both the alpha and beta viruses.

Transmission of the two curl viruses was obtained with all stages of *Aphis rubiphila*. No infection was obtained with *Amphorophora rubicola, Amph. rubi*, or *Amph. sensoriata.*

139. Bennett, C. W. 1932. Further observations and experiments with mosaic diseases of raspberries, blackberries, and dewberries. *Tech. Bull. Mich. agric. Exp. Sta.*, **125,** 32 pp.

Two general types of bramble mosaic are described: (1) yellow mosaic

characterized by yellowing of leaves, little or no mottling, and a high temperature maximum for symptom expression, (2) red raspberry mosaic characterized by mottling, necrosis of petioles and cane tips, and a lower temperature maximum for symptom expression. Though *Amphorophora rubi* is the chief vector of these mosaics, *A. rubicola* and *A. sensoriata* also transmitted red raspberry mosaic. *Aphis rubiphila*, the vector of culr, rarely if ever transmits mosaics. *Amphorophora rubi* acquired the virus of yellow mosaic in a feeding time of 2 hours and transmitted it to healthy plants during the following 48 hours. It acquired the virus of red raspberry mosaic in 12 hours and transmitted it during the following 12 hours. Aphids fed on healthy plants for short intervals lost the virus of red raspberry mosaic.

Bergelin, E. 1953. *See* **Johansson, E.,** and **Bergelin, E.**

140. Berger, A. 1924. A taxonomic review of currants and gooseberries. *Bull. N.Y. St. agric. Exp. Sta.*, **109,** 118 pp.
A taxonomic study of the wild and cultivated currants and gooseberries and their relatives, except those of the subgenera Berisia and Parilla. Sixty-seven species of *Ribes* and 52 of *Grossularia* are recognized, and the probable origin of a large number of hybrids is given.

141. Berkeley, G. H. 1925. Report of the Dominion Field Laboratory of Plant Pathology, St. Catherine's. *Rep. Domin. Botanist for 1924, Div. Bot., Dep. Agric. Canada*, pp. 32-9.
A survey of the Niagara peninsula made in 1924 showed mosaic to be prevalent on red, purple, and black raspberries and that certain blackberry varieties are also slightly susceptible.

142. Berkeley, G. H. 1927. Report of the Dominion Field Laboratory of Plant Pathology, St. Catherine's. *Rep. Domin. Botanist for 1926, Div. Bot., Dep. Agric. Canada*, pp. 59-102.
Natural mosaic infection has not been observed in Adams 87, although some bushes developed slight mosaic following inoculation with infected *Amphorophora rubi*. Herbert is also highly resistant in Ontario.

143. Berkeley, G. H. 1928. Report of the Dominion Field Laboratory of Plant Pathology, St. Catherine's. *Rep. Domin. Botanist for 1927, Div. Bot., Dep. Agric. Canada*, pp. 121-39.
Raspberry mosaic spread most rapidly in Marlboro, Viking, and King; no spread whatever took place during three years in Herbert, Adams 87, Newman 23, and Count.

144. Berkeley, G. H. 1930. Diseases of the raspberry. *Pamph. Dep. Agric. Canada*, **120, N.S.,** 23 pp. (Condensed from *Rev. appl. Mycol.*, **10,** pp. 392-3.)
Sunbeam, Herbert, King, Ohta, and Miller are susceptible to raspberry mosaic in Saskatchewan, while in the Maritime Provinces the disease is severe on Herbert and Cuthbert. Leaf curl is prevalent on Cuthbert in Quebec. Rosette is extremely severe on black raspberries in the eastern and middle western United States.

Herbert is particularly susceptible to spur blight.

The Columbian raspberry appears to be highly susceptible to crown gall. Anthracnose is severe only on black raspberries.

145. Berkeley, G. H., and **Chamberlain, G. C. 1944.** Diseases of the raspberry. *Fmrs' Bull.* **123,** being *Publ. Dep. Agric. Canada* **760,** 11 pp.

Virus diseases are found throughout Canada on wild and cultivated raspberries. The symptoms of mosaic, leaf curl, yellow blotch curl, and necrotic fern leaf mosaic are described. Of present commercial varieties, Cuthbert is the most susceptible to virus and also the most severely affected. Yellow blotch curl and necrotic fern leaf mosaic have been found only in Cuthbert, and leaf curl is rarely found in any other variety. On the other hand, all varieties, including black, purple, and yellow types, are more or less susceptible to mosaic. In Ontario, the red varieties may be listed in order of decreasing susceptibility as follows: Cuthbert, Viking, St. Regis, Newman, Latham, Taylor, Brighton, Count, Ohta, Lloyd George, Chief, Marcy, Newburgh, Herbert. Of the newer varieties, Ottawa is quite susceptible while Rideau, Madawaska and Trent have so far shown resistance.

The symptoms and control of the various fungus diseases are described. *Verticillium* wilt (*V. ovatum* Berkeley & Jackson, *V. dahliae* Kleb. and *V. albo-atrum* Rein. & Berth.) is more serious in poorly drained soils in young plantations of black raspberries. Cuthbert and Viking seem to be the most susceptible red varieties, while all the commercial black varieties show equal susceptibility. Spur blight (*Didymella applanata*) is widespread on all red varieties. Anthracnose (*Elsinoë veneta*) attacks red varieties but in general it is more severe on black raspberries. Cane blight (*Leptosphaeria coniothyrium*) is usually of minor importance but Latham is quite susceptible to it. Latham is also particularly susceptible to powdery mildew (*Sphaerotheca humuli*). Leaf spot (*Septoria rubi*) is rarely of importance. Late yellow rust (*Pucciniastrum americanum*) is found particularly on Viking, while orange rust (*Gymnoconia peckiana*) attacks the blackberry and occasionally the black raspberry, but not the red or purple varieties. Crown gall, *Phytomonas tumefaciens*, is more prevalent in lighter soils.

Various functional disorders are described, and illustrations of virus symptoms, *Verticillium* wilt, anthracnose, leaf spot, and crown gall are included.

Berry, W. E. 1936a and **b.** *See* **Swarbrick, T.,** and **Berry, W. E.**

146. Bicknell, E. P. 1910. Have we enough New England blackberries? *Bull. Torr. bot. Cl.* **37,** pp. 393-403.

In this taxonomic study of the New England blackberries, the putative hybrid origin of many of the so-called species is indicated.

Blackhurst, H. T. 1942. *See* **Yarnell, S. H.,** and **Blackhurst, H. T.**

Blackhurst, H. T. 1947. *See* **Yarnell, S. H.,** and **Blackhurst, H. T.**

147. Blake, M. A., Farley, A. J., and **Connors, C. H. 1913.** Report of the horticulturalist. *Rep. N.J. agric. Exp. Sta.*, pp. 89-173. (Condensed from *Exp. Sta. Rec.*, **32,** pp. 534-6.)

In pollen viability tests, the pollen of three varieties of gooseberries commenced to germinate well on April 21 and continued to do so for a period of nine days, a small percentage germinating as late as May 3.

With currants, ripe viable pollen occurred from about April 21 to May 12 or 14, depending on the variety.

Wilder, Pomona, and Red Cross were found to be self fertile.

148. Blanchard, W. H. 1904. A new species of blackberry. *Rhodora*, **6,** pp. 223-5.

Rubus recurvans n.sp. is described.

149. Blattny, C. 1930. (Notes on virus and similar diseases of plants. I.) *Ochrana Rostlin*, **10** (4-5), pp. 130-8.

Cultivated and a few wild varieties of gooseberry are affected with vein mosaic, symptoms varying with temperature. The disease was shown to be transmissible by aphids. It was also transmitted in 3% of the trials by larvae of *Nematus ventricosus*. Red and black currants, particularly the latter, suffer mostly from vein and diffuse types of mosaic, more rarely from aucuba mosaic; the affected plants have dwarfed shoots and are sterile.

150. Blodgett, E. C. 1935. Pathogenicity and physiology of *Pseudopeziza ribis*. *Phytopathology*, **25,** pp. 6-7 (Abstr.).

Studies of seven isolates of *Pseudopeziza ribis* from Canada and the Netherlands revealed considerable strain differences. Currant strains proved more pathogenic to currants than to gooseberry. All common garden varieties are liable to severe attack.

151. Blodgett, E. C. 1936. The anthracnose of currant and gooseberry caused by *Pseudopeziza ribis*. *Phytopathology*, **26,** pp. 115-52.

Eleven isolates of *P. ribis* from U.S., Canada, and Europe showed consistent differences in several morphological and physiological characters.

The optimum temperature for conidial germination was about 20° C., for ascospores about 12°, and for mycelial growth 20°. Optimal pH for growth in culture was 5·4-7·0.

Spores from isolates from currants were more pathogenic to currants than to gooseberries and vice versa. Plants were inoculated by spraying lower leaf surfaces with spore suspensions, then placing in a moist chamber for 12 or more hours. Penetration is direct through the epidermis.

Diseased leaves maintained over winter at 8-12° C. will form ascospores for spring inoculations, and viable ascospores were obtained from gooseberry leaves collected in May 1933 and stored at 4° C. until April 1934.

Boase, M. 1951. *See* **Wood, C. A., and Boase, M.**

152. Bohn, G. W., and Maloit, J. C. 1945. Inoculation experiments with *Pseudomonas ribicola*. *Phytopathology*, **35,** pp. 1008-16. (Condensed from *Rev. appl. Mycol.*, **25,** p. 349.)

Inoculum rubbed with fairly stiff brushes and cotton pads on leaves dusted with 300-mesh carborundum yielded abundant infections similar to those observed in nature. It is concluded that *P. ribicola* is a wound parasite which normally enters currant leaves through minute injuries resulting from natural mechanical damage.

153. Bois, E. 1953. (The raspberry Romy.) *Rev. hort. Suisse*, **26,** pp. 68-70. (Condensed from *Plant Breed. Abstr.*, **23,** p. 464.)

This new autumn-fruiting variety from Geneva has deep red, scented

fruits which plug easily; they are obtusely conical, shiny, and have fine hairs. Resistance to disease and to frosts, with temperatures as low as −3° C. in mid November, is good.

154. Boll, H. L., and Colby, A. S. 1955. Crimson Cone, a new raspberry variety. *Fruit Var. hort. Dig.*, **10**, p. 44.
Developed from Latham × Milton at the Illinois Agricultural Experiment Station, Crimson Cone is a summer-bearing variety highly resistant to winter killing.

155. Bologovskaya, R. P. 1934. (The blackberry.) *Sci. Pop. Monograph, Leningrad, No.* **51**, 110 pp. (Condensed from *Plant Breed. Abstr.*, **5**, p. 255.)
The origin and classification of cultivated forms of blackberry are briefly dealt with and the main agronomic features of a number of the best varieties are tabulated. Descriptions and illustrations are given of the main species and of a number of hybrids.

The main breeding objectives in the Soviet Union are frost resistance, fungal immunity, spinelessness, firm and erect stems, high yield and sugar content of the fruit, and tenderness combined with transportability.

Rubus caucasicus, *R. anatolicus*, and *R. turkomanicus* are all distinguished by the abundance and large size of their fruit, which is black, shiny and sweet. The forms of *R. caesius* found in the north of the U.S.S.R. and in Siberia are very frost resistant. The use of these and other species in hybridization is therefore recommended.

Selection is mainly carried out in the first to third year of growth. The characters selected are: vigour, large leaves with wavy and wrinkled surface, thick shoots, large stipules with regular, undented margins, early acquisition of a dark pigment in the stems (sign of maturity), high quality of fruit and as few spines as possible. Success can only be attained if large-scale breeding is adopted.

Texas, a variety produced by Mičurin from a loganberry seedling, is characterized by fruits up to 39 mm. long and 9·55 g. wt., one bush yielding 7·2 kg. of large, well-flavoured berries; it is frost resistant and free from disease.

156. Bologovskaya, R. P., Katinskaya, J. K., Pavlova, N. M., and Rozanova, M. A. 1936. (Flora of cultivated plants. XVI. Small fruits.) State Agric. Publishing Co., Moscow and Leningrad, 285 pp.

157. Bologovskaya, R. P. 1940. (The raspberry 'Kuz'min's Novelty'.) *Plodovo-Jagodnye Kul'tury* (Fruit Crops), No. 5, pp. 73-4. (Condensed from *Plant Breed. Abstr.*, **14**, p. 69.)
Kuz'min's Novelty is one of the most frost resistant varieties known. It is early fruiting and also partially autumn-fruiting and is free from all the diseases and pests that affect most raspberries in Siberia.

158. Bologovskaya, R. P. 1940. (Breeding small fruits in Siberia and the Far East.) *Plodovo-Jagodnye Kul'tury* (Fruit Crops), No. 4, pp. 64-8. (Condensed from *Plant Breed. Abstr.*, **14**, pp. 68-9.)
The wild Siberian currant has larger berries than European black currant varieties and is much hardier. Some Siberian types contain up to 200 mg. vitamin C per 100 g. and yield 5-6 kg. of fruit per bush. Eight improved varieties have been selected.

For red currant breeding two species are of interest; *Ribes palczewskii* combines extreme earliness with large berries of excellent flavour; *R. manschuricum* is late ripening. *R. atropurpureum* and *R. altissimum* are of interest for their hardiness, resistance to anthracnose, robust growth, and large acid fruits.

Grossularia acicularis is the hardiest species of gooseberry known. The Altai mountains are rich in gooseberry types varying in yield, fruit size, spininess, and *Sphaerotheca* resistance. *G. burejense*, a Far Eastern wild species, is resistant to mildew and frost.

159. Bolton, A. T., and **Racicot, H. N. 1950-1951.** Cultural and inoculation studies on *Elsinoë veneta*, the causal organism of anthracnose of raspberry. *Rep. Que. Soc. Prot. Plants*, **32** and **33**, pp. 51-3.

The fungus was isolated from cane lesions and cultured on raspberry extract agar medium. Conidia were produced in sufficient abundance to inoculate large numbers of raspberry seedlings with a suspension. Plants inoculated at 60° F. and 95% relative humidity evinced symptoms in 2-3 weeks.

160. Borisoglebskii, A. D. 1948. (Plant breeders of the Estonian SSR.) *Sad i Ogorod* (Fruit and Veg. Gdns) No. 6, pp. 32-4. (Condensed from *Plant Breed. Abstr.*, **19**, p. 374.)

Ja. Raega bred the hardy, mildew resistant gooseberry variety Rae 1 by hybridization between the American Mountain gooseberry and Red Oak. Ju. Aamisepp bred the gooseberry Iaanike from Krasnyi Oreh (Red Nut) × Hauton (Houghton); it is hardy and resistant to mildew, rust, and anthracnose. He also bred the hardy black currant, Anneke, from Goliath × Boskoop Giant.

161. Boyce, J. S. 1924. Investigation work on white pine blister rust in the Pacific Northwest for 1922. *Phytopathology*, **19**, p. 124 (Abstr.)

Cronartium ribicola was probably introduced into the Pacific coast region from France in 1910, on *Pinus strobus* planted at Vancouver. All western species of *Ribes* and *Grossularia* are susceptible.

162. Bradford, F. C. 1922. Observations on winter injury. I. Early and late winter injury. *Res. Bull. Mo. agric. Exp. Sta.*, **56**.

163. Braeucker, T. 1882. (292 German predominant Rhineland *Rubus* species and forms.) A. Stubenrauch, Berlin.

164. Brainerd, E. V., and **Peitersen, A. K. 1920.** Blackberries of New England—their classification. *Bull. Vt agric. Exp. Sta.*, **217**, 84 pp. (Condensed from *Exp. Sta. Rec.*, **44**, p. 237.)

A systematic study of the species, hybrids and blend hybrids of Eubatus in New England. Keys (together with illustrations and descriptions) are given for the twelve species of New England *Eubatus* and also for a number of hybrids. The descriptions include information on pollen viability.

165. Brandtsegg, O., and **Kvale, E. 1947.** (Black currants at Kvithamar 1931-45.) *Meld. Stat. Forsøksgard Grønsakdyrking Kvithamar Stjørdal 1945*, **26**, pp. G57-60. (Condensed from *Plant Breed. Abstr.*, **18**, p. 367.)

A comparison of yields, habit, reaction to frost, and other economic

features of eight varieties of black currant based on their performance during 14 years at Kvithamar, Norway.

Braun, A. J. 1943. *See* **Zeller, S. M., and Braun, A. J.**

Braun, A. J. 1953. *See* **Slate, G. L., Braun, A. J., and Mundinger, F. G.**

166. Brierley, W. G. 1930. A study of senescence in the red raspberry cane. *Tech. Bull. Minn. agric. Exp. Sta.*, **69,** 36 pp.

167. Brierley, W. G. 1930. Cambial activity in the red raspberry cane in the second season. *Proc. Amer. Soc. hort. Sci.*, **26,** pp. 278-80.

168. Brierley, W. G. 1931. Effect of height of pruning on size of berries and yield in the Latham raspberry. *Bull. Minn. agric. Exp. Sta.*, **281.**

169. Brierley, W. G. 1932. Notes on the fall flowering habit of the red raspberry. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 180-1.
Briefly draws attention to the autumn fruiting character in Cuthbert and Ranere and points out that McMahon recorded autumn fruiting in 1806.

170. Brierley, W. G. 1932. Growth studies in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 182-7.

171. Brierley, W. G. 1932. Transpiration in new and old canes of the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 188-93.

172. Brierley, W. G. 1933. Effect of removal of fruiting canes after harvest upon the growth of new canes in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **29,** pp. 300-1.

173. Brierley, W. G. 1934. Winter desiccation in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **31,** pp. 110-13.

174. Brierley, W. G. 1934. Studies of the response of the Latham raspberry to pruning treatment. *Tech. Bull. Minn. agric. Exp. Sta.*, **100,** 30 pp.

175. Brierley, W. G. 1943. Three-year-old fruiting canes in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **42,** pp. 444-6.
By preventing spawn production and by disbudding, it was found possible to prolong the life of second-year Latham canes so that they produced a few fruiting laterals in the third year.

176. Brierley, W. G. 1945. Questions on hardiness in raspberries. *Minn. Fruit Gr*, **12** (4), pp. 3, 6, 15, 18.

177. Brierley, W. G. 1945. Why do hardy raspberries winter kill? *Minn. Hort.*, **73,** p. 119.

178. Brierley, W. G., and Landon, R. H. 1946. A study of cold resistance of the roots of the Latham red raspberry. *Proc. Amer. Soc. hort. Sci.*, **47,** pp. 215-18.
The roots of Latham when undisturbed in the soil are able to withstand much lower temperatures than those reported by Carrick (1920) for other

varieties. Injury followed exposure to temperatures below −2° F. and the killing point appeared to be between −6 and −9° F.

179. Brierley, W. G., and **Landon, R. H. 1946.** Some relationships between rest period, rate of hardening, loss of cold resistance and winter injury in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **47,** pp. 224-34.

Under Minnesota conditions deep rest of the Latham raspberry occurs in mid October and is broken by early December. Declining temperatures that break the rest also cause rapid development of cold resistance. Severe injury occurring after mild spells shows that cold resistance is quickly lost. Objectives in breeding for 'hardiness' in raspberries should include, in addition to a high degree of ultimate cold resistance and ability to harden rapidly, such factors as (*a*) retention of cold resistance once attained, (*b*) longer rest or deeper dormancy in order to avoid out-of-season bud activity, and (*c*) ability to reharden if initial cold resistance is lost.

180. Brierley, W. G. 1948. Preliminary report of an informal co-operative study of rest in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **51,** pp. 316-18.

Length of growing season had little effect on rest, the patterns of onset and decline were similar for all localities but intensity varied. Rest behaviour of Latham is far from uniform over the range from south to north.

181. Brierley, W. G., Landon, R. H., and **Stadtherr, R. J. 1952.** The effect of daily alterations between 27° and 39° F. on retention or loss of cold resistance in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **59,** pp. 173-6.

182. Briton-Jones, H. R. 1925. A note on the leaf spot disease of black currants. *Rep. Long Ashton Res. Sta.*, pp. 105-8.

Baldwin showed a heavier attack of *Pseudopeziza ribis* than did Seabrook's Black and Boskoop Giant, probably due to heavy cropping and weak growth.

183. Brooks, R. M., and **Olmo, H. P. 1944.** Register of new fruit and nut varieties. *Proc. Amer. Soc. hort. Sci.*, **45,** pp. 467-90.

Blackberry

Acme Thornless Young.—Originated in Chino, California, by E. L. Pollard and J. E. Sherrill and introduced in 1930. A thornless bud mutation of Young with the characteristics of the parent, but greater susceptibility to disease.

Bauer Thornless Logan.—Originated in San Gabriel, California, by B. E. and G. R. Bauer and introduced in 1934. Bud mutation of Logan; discovered in 1929. Plant: canes and leaves entirely thornless; canes strong; season earlier and longer than that of the parent.

Brainerd.—Originated in Atlanta, Georgia, by the U.S. Department of Agriculture (G. M. Darrow) and introduced in 1932. Himalaya × an eastern erect-growing variety (possibly Georgia Mammoth). Fruit: large; quality high; good for preserving, canning, and freezing. Bush: extremely productive and vigorous; very hardy.

Cascade.—Originated in Corvallis, Oregon, by the U.S. Department of Agriculture (G. M. Darrow and G. F. Waldo) and introduced in 1940. Zielinski × Logan. Fruit: excellent for canning or freezing; flavour

characteristic of the native blackberry (*R. macropetalus*). Bush: vigorous and productive.

Pacific.—Originated in Corvallis, Oregon, by the U.S. Department of Agriculture (G. M. Darrow and G. F. Waldo) and introduced in 1940. Zielinski × Logan. Fruit: excellent for canning and freezing; firmer than Cascade and more acid; flavour characteristic of the native blackberry (*R. macropetalus*). Bush: vigorous and productive.

Thornless Boysen.—Originated in El Monte, California, by D. L. Duffin and introduced in 1938. Bud mutation of Boysen. May be identical with Acme Thornless Young.

Gooseberry

Glenndale.—Originated in Little Silver, New Jersey, by the U.S. Department of Agriculture (W. Van Fleet) and introduced in 1932. ((*Grossularia missouriensis* × Red Warrington) × Triumph) × Keepsake. Fruit: excellent for jam; seeds small. Plant: vigorous; best for southern limit of gooseberry growing.

Raspberry

Milton.—Originated by the New York State Agricultural Experiment Station and introduced in 1942. Lloyd George × Newburgh; cross made in 1927. Fruit: bright red; firm; large; quality good; ripens late; most nearly resembles Taylor. Plant: vigorous; productive; escapes mosaic.

Potomac.—Originated in Glenn Dale, Maryland, by the U.S. Department of Agriculture (G. F. Waldo) and introduced in 1933. Farmer black raspberry × Newman red raspberry. Fruit: purple; well suited for canning and preserving. Bush: resistant to fungus disease; free from virus diseases; vigorous; productive.

Tahoma.—Originated by the Western Washington Experiment Station and introduced in 1938. Latham × Lloyd George. Fruit: red; ripens very early; shipping quality good. Plant: hardy; escapes mosaic infection; resistant to western yellow rust.

Tennessee Autumn (*Tennessee No. Y944*).—Originated by the Tennessee Agricultural Experiment Station and introduced in 1940. Tennessee Seedling 181 × Lloyd George. Fruit: red; quality good. Plant: healthy; production heavy; some southern adaptation; autumn fruiting.

Van Fleet.—Originated in Chico, California, by the U.S. Department of Agriculture (W. Van Fleet) and introduced in 1924. *Rubus kuntzeanus* × Cuthbert. Female parent collected in China. Fruit: red. Plant: very vigorous; highly productive; resistant and hardy in southern states where other raspberry plants do not succeed.

Viking.—Originated by the Ontario Horticultural Experiment Station and introduced in 1924. Cuthbert × Marlboro. Fruit: red; ripens early midseason; large, bright, good market berry, easily picked. Most nearly resembles Cuthbert.

Washington.—Originated by the Western Washington Experiment Station and introduced in 1938. Cuthbert × Lloyd George. Fruit: red; quality high; suitable for canning and freezing. Plant: definite rest period; production heavy; escapes mosaic infection; resistant to western yellow rust.

Willamette.—Originated in Corvallis, Oregon, by the U.S. Department of Agriculture (G. F. Waldo) and introduced in 1943. Newburgh × Lloyd George. Fruit: red; large; excellent for shipping; firm; most nearly resembles Newburgh but fruit is darker.

184. Brooks, R. M., and Olmo, H. P. 1946. Register of new fruit and nut varieties. List No. 2. *Proc. Amer. Soc. hort. Sci.*, **47**, pp. 544-69.

Blackberry

Bowen.—Originated in Burlingame, California, by J. C. Bowen and introduced in 1944. From a wild thornless blackberry. Fruit: large, matures early, seeds very small. Bush: thornless, does not sucker or propagate from root cuttings. Quite productive. Possibly identical with Cory Thornless.

John Innes.—Originated by the John Innes Institute (M. B. Crane) and introduced in the U.S. in 1944. *Rubus rusticanus* × *R. thyrsiger*. Fruit: very firm, sweet, late, might be valuable for home use. Most nearly resembles Oregon Evergreen blackberry.

Lowden.—Originated in Hamilton, Ontario, by Edward Lowden and introduced in 1939. Possibly a mutation of Snyder. Fruit: core small, colours uniformly. Bush: hardy, productive, resistant to orange rust.

Gooseberry

Fredonia.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1927. Open pollinated seedling of unknown English-type gooseberry. Fruit: very large, deep red, late, good quality, keeps and ships well. English type.

Raspberry

Brant.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1925. Smith No. 1 × June. Fruit: purple, large, handsome, firm, holds up well, good quality. No longer cultivated because of mosaic.

Bristol.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1934. Watson Prolific × Honeysweet. Fruit: black, large, firm, fairly glossy, attractive, quality excellent, one week earlier than Naples. Bush: hardy, vigorous, productive. Now widely planted as one of the best varieties.

Cayuga.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1922. June × Cuthbert. Fruit: red, ripens before Cuthbert which it resembles. Bush: productive, suckers heavily. Now superseded by better varieties.

Dundee.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1927. Smith No. 1 × Palmer. Fruit: black, large, glossy, small drupelets, attractive, moderately firm, quality very good. Bush: tall, vigorous, productive, moderately resistant to mosaic.

Evans.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1936. Watson Prolific × Honeysweet. Fruit: black, high quality, very glossy, attractive, only moderately firm. Little grown in New York, considered promising in southern California.

Gatineau (*0-276*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1943. Lloyd George × Newman. Fruit: red, early.

Indian Summer.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1936. (Empire × Herbert) × Lloyd George. Fruit: red, very aromatic, crumbles frequently, useful for jam, superior to Ranere and Erskine Park, quality good as an autumn fruiting variety. Bush: very productive, escapes mosaic infection [in U.S.]. Planted extensively in home gardens.

Johnson Everbearing.—Originated in Davis, West Virginia, by A. W.

Johnson and introduced in 1945. Parentage unknown. Fruit: black, large. Bush: pronounced fall-bearing habit. Most nearly resembles Cumberland.

Lloyd George.—Originated as a chance seedling in Dorsetshire, England, and introduced in the U.S. in 1929. Parentage unknown. Fruit: red, excellent quality. Now sparingly grown. An outstanding parent in breeding new varieties.

Madawaska (*0-272*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1943. Lloyd George × Newman. Fruit: dark red, excellent canner, early. Bush: hardy.

Marcy.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1936. Lloyd George × Newman. Fruit: red, very large, firm, thick fleshed, quality good, goes too dark when fully ripe. Bush: not hardy, escapes mosaic.

Marion.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1937. Bristol × New York 2585 (Newman × Herbert). Fruit: purple, large, moderately juicy, firm, acid, good quality, late. Bush: resembles red raspberry in habit.

Milton.—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1942. Lloyd George × Newburgh. Fruit: red. Escapes mosaic.

Monroe.—Originated by the New York State Agricultural Experiment Station (R. Wellington); introduced in 1932. Newman × Cuthbert. Now superseded by better varieties.

Naples.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1932. Honeysweet × Rachel. Fruit: black, large, firm, glossy, attractive, good quality. Bush: vigorous, productive, hardy, susceptible to mosaic. Plantings decreasing.

Newburgh.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1929. Newman × Herbert. Fruit: red, very large, firm, bright colour, keeping and shipping quality very good. Bush: mosaic is rarely serious. An important commercial variety.

Newman (*Newman 23*).—Originated at Ville La Salle, Quebec, Canada, by C. P. Newman and introduced in 1924. Parentage unknown. Fruit: red, large, season as Cuthbert or a little later. Bush: susceptible to mosaic. Variety now almost obsolete.

Ottawa (*0-275*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1943. Viking · (Logan × Ranere). Fruit: red, firm, good shipper. Most nearly resembles Viking.

Owasco.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1922. June × Cuthbert. Fruit: red, excellent in every way. Bush: poor growth, variable in habit, now eliminated by mosaic.

Rideau (*0-262*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1943. Lloyd George × Newman. Fruit: red. firm, good shipper, bright.

Seneca.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1922. June × Cuthbert. Fruit: red. Bush: almost identical with Cayuga, but shorter and with fewer prickles. Now eliminated by mosaic.

Sodus.—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1935. Dundee × Newburgh. Fruit: purple, large, firm, quality good, season shortly after Latham. Bush: very vigorous, very productive, hardy, susceptible to mosaic and *Verticillium* wilt. Now an important commercial variety.

Taylor.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1935. Newman × Lloyd George. Fruit: red, ripens with Latham, very large, bright, does not crumble, picks easily, good quality. Bush: vigorous, productive, tall, increases rapidly, more subject to mosaic than Newburgh.

Tennessee Luscious (*Tennessee X37*).—Originated by the Tennessee Agricultural Experiment Station (B. D. Drain) and introduced in 1944. Lloyd George × Tennessee VVF 169 (Van Fleet × Viking). Fruit: large, firm, conic, glossy, drupelets strongly coherent, very good flavour, late.

Trent (*0-264*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1943. Newman × Lloyd George. Fruit: red, early. Bush: hardy.

Webster.—Originated by the New York State Agricultural Experiment Station (R. Wellington) and introduced in 1926. Smith No. 1 × an unknown purple raspberry seedling. Fruit: medium size, dull dark purple, firm, acid, fair quality. Bush: slow growing, not very productive.

185. Brooks, R. M., and **Olmo, H. P. 1947.** Register of new fruit and nut varieties. List No. 3. *Proc. Amer. Soc. hort. Sci.*, **50,** pp. 426-42.

Blackberry

Big-Ness (*Texas R40-51*).—Originated by Texas Agricultural Experiment Station (S. H. Yarnell), and introduced 1946; parentage F_3 of *Rubus rubrisetus* × Nessberry. Fruit is large and the crop early; the bush is vigorous and resistant to 'little-fruit'.

Cameron.—Originated by North Carolina Agricultural Experiment Station (C. F. Williams), and introduced in 1938; parentage Young × Lucretia. Fruit shiny black, larger and sweeter than Lucretia. The bush is productive, vigorous, disease resistant, and of dewberry type.

Earli-Ness (*Texas R40-4*).—Originated by Texas Agricultural Experiment Station (S. H. Yarnell), and introduced 1946; selected from F_3 of *Rubus rubrisetus* × Nessberry. Earliest variety known; vigorous; resistant to "little-fruit".

Kosmos (*Kosmo*).—Originated in Oregon by P. W. Meredith from unknown parents. The fruit is soft and the bush very susceptible to leaf spot.

Olympic.—Originated in Washington by P. Erickson and introduced in 1930. Parentage: Young × Plum Farmer? Fruit is similar to Young.

Regal-Ness (*Texas R40-202*).—Originated by Texas Agricultural Experiment Station (S. H. Yarnell), and introduced 1946; selected from F_3 of *Rubus rubrisetus* × Nessberry. Fruit matures early and the bush is resistant to 'little-fruit'.

Currant

Red Lake.—Originated by Minnesota Agricultural Experiment Station (W. H. Alderman), and introduced in 1933. Fruit large, clusters long and well filled.

Viking (Holländische Rote, Rød Hollandsk Druerips).—Originated in Europe from *Ribes petraeum* Wulf. × *R. rubrum* L. (direction of cross not known). Fruit red, late. Plant is immune to *Cronartium ribicola* and is productive.

Gooseberry

Pixwell.—Originated by North Dakota Agricultural Experiment Station (A. F. Yeager), and introduced in 1932; parentage Oregon Champion × *Ribes missouriense*. Fruit medium sized, pink, borne in clusters and has long pedicels; few thorns. Bush is hardy and very productive.

Raspberry

Dike.—Originated by A. C. Dike, Bristol, Vermont, and introduced about 1926; from Latham × Cuthbert. Fruit red and of good quality; bush is hardy and resistant to mosaic.

Dixie.—Originated by North Carolina Agricultural Experiment Station (C. F. Williams), and introduced 1938; from *Rubus biflorus* × Latham. Fruit red, medium sized, tart. Bush is vigorous, productive, disease resistant, adapted to south-eastern states south of the red raspberry region.

Durham.—Originated by New Hampshire Agricultural Experiment Station (A. F. Yeager), and introduced 1947; from Taylor × Nectar blackberry but probably a parthenogenetic seed of Taylor. Fruit red, firm, medium sized; autumn fruiting, with the fall crop two weeks earlier than Indian Summer.

Morrison (*Morris*).—Originated by F. Morris, North Kingsville, Ohio, and introduced 1942; parentage unknown. Fruit late, black, large, attractive.

Ruddy.—Originated by North Dakota Agricultural Experiment Station (A. F. Yeager) and introduced in 1937; from F_2 of Plum Farmer × Latham. The fruit is purple; the bush crops well and reproduces by suckers; it is resistant to red spider and very hardy.

Sunrise.—Originated by U.S. Department of Agriculture, Maryland (G. M. Darrow), and introduced in 1939; from Latham × Ranere. Fruit: very early, red, better quality than Latham, fine texture, does not crumble, picks easily. Bush resistant to leaf spot and anthracnose, very hardy.

Yellow Honeysweet (*Honeysweet*).—A golden yellow unidentified variety of French origin.

186. Brooks, R. M., and **Olmo, H. P. 1949.** Register of new fruit and nut varieties. List No. 4. *Proc. Amer. Soc. hort. Sci.*, **53,** pp. 573-88.

Currant

Cascade (*Minnesota No. 70*).—Originated by the University of Minnesota Fruit Breeding Farm and introduced in 1942. Open pollinated seedling of Diploma. Fruit larger than Red Lake and one week later. Bush productive, erect, medium vigour.

Gooseberry

Como (*Minnesota No. 43*).—Originated by the University of Minnesota Fruit Breeding Farm and introduced in 1922. Pearl × Columbus. Fruit greenish yellow, good quality. Bush very productive, resistant to sunscald.

Raspberry

Chief (*Minnesota No. 223*).—Originated by the University of Minnesota Fruit Breeding Farm and introduced in 1930. Latham selfed. Fruit early, good quality. Bush hardy, vigorous.

Latham (*Minnesota No. 4*).—Originated by the University of Minnesota Fruit Breeding Farm and introduced in 1920. King × Louden. Fruit high quality. Bush hardy, productive, markedly tolerant of mosaic.

September (*New York No. 17438*).—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1947. Marcy × Ranere. Fruit bright red, firm, medium size, not crumbling; quality of summer crop is only fair, but the autumn berries are good quality; summer crop is as early as Indian Summer or June and the fall crop ripens 2 to 4 weeks before that of Indian Summer; the summer berries particularly do not plug easily. Bush vigorous, increases rapidly, hardy at Geneva, crops well; reaction to mosaic not known.

87. Brooks, R. M., and **Olmo, H. P. 1950.** Register of new fruit and nut varieties. List No. 5. *Proc. Amer. Soc. hort. Sci.*, **56,** pp. 509-37.

Blackberry

Chehalem (*Oregon 731*).—Originated by the Oregon Agricultural Experiment Station (G. F. Waldo) and introduced in 1948. Santiam × Himalaya. Fruit bright black, excellent for freezing, smaller than Logan. Bush probably has limited range of adaptation, vigorous and productive in moist, rich soils.

Kayberry.—Originated in Chehalis, Washington, by Mrs. M. P. Kelly and introduced in 1948. Fruit: small seeds, soft core, good for shipping and freezing, excellent for jam. Most nearly resembles California Mammoth. Bush: productive.

Nectar (*Nectarberry*).—Originated in El Monte, California, by H. G. Benedict and introduced in 1937. Reputed to be a seedling of Young but possibly a chimaera of Boysen. Fruit: greater in diameter than Boysen and the drupelets are larger. Bush: trailing, more or less identical with Boysen.

Olallie (*Oregon 609*).—Originated by the Oregon Agricultural Experiment Station (G. F. Waldo) and introduced in 1950. Black Logan × Young. Fruit shiny black, firm and large, most nearly resembles Mammoth blackberry. Bush productive, adaptable to California and western Oregon conditions.

Currant

Coronet (*Ottawa 393*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1948. *Ribes ussuriense* Jancz. × Kerry. Fruit black. The variety is immune from rust (*Cronartium ribicola*).

Crusader (*Ottawa 381*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1948. *Ribes ussuriense* Jancz. × Kerry. Fruit is black and the variety is immune from rust (*Cronartium ribicola*).

Raspberry

Bonanza.—Originated in Ontario, California, by Armstrong Nurseries Inc. (H. C. Swim) and introduced in 1949. Sunrise × Washington. The fruit ripens two to three weeks earlier than Sunrise and tends to continue fruit production throughout the growing season with a heavier crop in the fall. The variety is vigorous with a low chilling requirement, and crops heavily in southern California.

Honeyking.—Originated in Parkside, Saskatchewan, Canada, by A. J. Porter and introduced in 1948. Viking × native raspberry. Fruit red, very good for canning but too small where standard sorts can be grown. Bush cold resistant and yields well.

Honeywood.—Originated in Parkside, Saskatchewan, Canada, by C. Swan and introduced in 1941. Parentage unknown. Fruit black, medium size and of good quality. The plant is not entirely winter hardy.

Magnaberry.—Originated in Ontario, California, by Armstrong Nurseries Inc. (H. C. Swim) and introduced in 1949; F_3 of Nessberry × Sodus. Fruit combines the flavour of raspberry and blackberry and is excellent for jam. Bush large, vigorous, crops heavily.

Mortgage Lifter.—Originated in Berrien County, Michigan, by O. K. White and introduced in 1949; parentage unknown. Fruit black, sweet, and early ripening; fruiting continues throughout the season.

Park Black.—Originated in Des Moines, Iowa, by C. Park and introduced in 1950. Open pollinated seedling of Cumberland. Fruit: long and large, very uniform in size, good flavour. Bush: hardy, vigorous, a heavy cropper, relatively free from disease.

Tennessee Prolific.—Originated by the Tennessee Agricultural Experiment Station (B. D. Drain), and introduced in 1948; Lloyd George × Tennessee Seedling VVF 169. The fruit ripens about the same season as Latham, is firm, and suitable for freezing. It is well adapted to Tennessee and nearby regions.

Toms.—Originated in Nevada, Iowa, by L. E. Toms and introduced in 1948; Chief × Plum Farmer. The fruit is red, of good quality, and is borne over a long season. The variety is very disease resistant.

Tweed (*Ottawa 263*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1946; Newman 23 × Lloyd George. The fruit is red and early. The plant crops heavily and is very hardy at Ottawa.

Vandyke (*Ontario 2504137*).—Originated by the Ontario Horticultural Experiment Station and introduced in 1947. Adams 87 × Viking. The fruit is large, of good quality, and earlier than Viking. The variety is heavy cropping, upright, and almost spineless but is not resistant to virus.

188. Brooks, R. M., and **Olmo, H. P. 1951.** Register of new fruit and nut varieties. List No. 6. *Proc. Amer. Soc. hort. Sci.*, **58**, pp. 386-407.

Blackberry

Bailey.—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1950; parentage unknown. Fruit large, medium firm, good quality, sub-acid. Plant productive.

Ebony King.—Introduced about 1940 by Krieger's Nursery, Bridgman, Michigan; parentage unknown. Fruit large as Eldorado, early, good flavour. Bush upright, hardy, resistant to orange rust.

Hedrick.—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1950; Eldorado × Brewer. Fruit large, medium firm, pleasantly tart. Plant productive.

Merton Thornless.—Originated by the John Innes Institute (M. B. Crane); John Innes ♂ a thornless selfed John Innes seedling. Fruit large, round, with large drupelets, mid-season. Bush thornless, tetraploid, vigorous, not a good cropper.

Rusk's King.—Originated in Oregon by W. H. Rusk and introduced in 1942; parentage unknown. Fruit large, dark red, juicy, no core, few seeds, pleasant flavour, not too tart; quality good for dessert, jam or freezing. Bush productive, vigorous, hardy.

Currant

Stephens (*Stephens 9*).—Originated in Ontario by C. L. Stephens and introduced in 1933; parentage unknown. Fruit very large, attractive, red, sub-acid; excellent quality; clusters medium-long, comparable to Red Lake. Bush vigorous, somewhat spreading, very hardy, productive.

Raspberry

Amber.—Originated by the New York State Agricultural Experiment Station (G. L. Slate) and introduced in 1950; parentage Taylor × Cuthbert. Fruit amber, large, sweet, good flavour. Plant very vigorous.

Muskoka (*Ottawa 201*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1950. Newman 23 × Herbert. Extremely winter hardy.

Sonoma.—Originated by E. E. Roach, Glenn Ellen, California, and introduced in 1951. (St. Regis × Latham) × (Cuthbert × Latham.) Fruit large. Plant everbearing; able to withstand and bear fruit in hot summer and low humidity; bears fruit to mid December.

Taxpayer.—Originated by A. B. Curtis, Sarona, Wisconsin, and

introduced 1934; selected from the wild. Fruit pale creamy pink (too light for ready sale). Canes almost thornless.

Ulster.—Originated by the New York State Agricultural Experiment Station (R. Wellington); Herbert × June. Fruit is large, red, soft, and of fair quality. Plant vigorous and productive.

189. Brooks, R. M., and **Olmo, H. P. 1952.** Register of new fruit and nut varieties. List No. 7. *Proc. Amer. Soc. hort. Sci.*, **60,** pp. 497-504.

Gooseberry

Captivator (*Ottawa 272*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1952; Spinefree × Clark. Fruit equal in size to the best American varieties. Plant thornless.

Raspberry

Early Red.—Originated by the Michigan State College South Haven Agricultural Experiment Station and introduced in 1952; Lloyd George × Cuthbert. Fruit early, large, round-conical; plugs easily, flavour very good; cans well without crumbling; freezes as well as Latham. Plant upright, tall, vigorous, hardy, very productive; canes numerous, thickly covered with stiff reddish-brown prickles.

Newberrys.—Originated in Port Angeles, Washington, by F. A. Newberry and introduced in 1951; bud mutation of either Cuthbert or St. Regis. Fruit large, drupelets large and numerous, matures late, highly flavoured.

190. Brooks, R. M., and **Olmo, H. P. 1953.** Register of new fruit and nut varieties. List No. 8. *Proc. Amer. Soc. hort. Sci.*, **62,** pp. 513-26.

Currant

Consort (*Ottawa 396*).—Originated by the Central Experimental Farm, Ottawa, and introduced in 1952; Kerry × *Ribes ussuriense*. Fruit black. Plant immune from *Cronartium ribicola*. Self fruitful, does not require insect pollination.

Raspberry

Golden Willamette.—Originated in Otisville, Orange County, New York, by B. Altbayer and introduced in 1952; bud mutation of Willamette. Fruit golden yellow, flavour good, picks easily; bears in summer and fall. Bush bears well, vigorous.

Canby (*Oregon 549*).—Originated in Corvallis, Oregon (G. F. Waldo) and introduced 1953; Viking × Lloyd George. Fruit red, excellent keeping qualities as a dessert berry; very suitable for freezing; large. Bush: canes are tall, straight and thick; fruit production habit excellent; dies in poorly drained soils.

Golden Indian Summer.—Originated in Otisville, Orange County, New York, by B. Altbayer and introduced in 1952; bud mutation of Indian Summer. Fruit yellow, autumn fruiting, large, picks easily. Bush vigorous.

Thames (*Ottawa 271*).—Originated by the Central Experimental Farm, Ottawa, and introduced 1952; Lloyd George × Newman 23. Fruit bright red, good for freezing, very late.

191. Brown, A. G. 1954. Pomology department. *Rep. John Innes hort. Instn for 1953*, pp. 7-12.

G. M. Haskell has shown that 17% outcrossing occurs in Merton Thornless blackberry. Hybrid seeds tended to germinate earlier than selfed seeds.

In raspberries, seedling mortality is high in selfed progenies but low in sibs and backcrosses. There is no relationship between spine colour and density. Crosses between black and red raspberries show height heterosis.

192. Brown, A. G. 1955. Department of plant breeding. *Rep. John Innes hort. Instn for 1954*, pp. 6-11.
Wild raspberry strains have been collected from various parts of Great Britain.

Crane selected Merton Thornless blackberry from a total of 37 thornless plants, discarding 835 thorned. G. M. Haskell repeated the cross, sowing 16,000 seeds from which he obtained 450 thornless seedlings (eglandular cotyledons) for field planting and was able to discard 12,000 potentially thorned plants with glandular cotyledons.

193. Brown, J. F. 1950. Raspberry and blackberry culture. *Bull. Ont. agric. Coll.*, **473**, 41 pp.
Varieties suitable for Ontario are described.

194. Brown, S. W. 1943. The origin and nature of variability in the Pacific coast blackberries (*Rubus ursinus* Cham. & Schlecht. and *R. lemurum* sp. nov.). *Amer. J. Bot.*, **30**, pp. 686-97. (Condensed from *Exp. Sta. Rec.*, **90**, p. 608.)
The Pacific coast blackberries show a considerable range of chromosome numbers, the most common number being 56 in the greater part of California and 84 in northern California and southern Oregon. At the juncture of the 56- and 84-chromosome types in northern California, plants with 42 and 70 chromosomes were found. Along the central coast of California, in addition to the common 56-chromosome form, plants with 63, 70, 77 and 84 occurred. The extremely limited occurrence of clones with odd multiple chromosome sets suggests that pseudogamy has had little part in the development of Pacific coast blackberries. The extinct parental type of the Pacific coast was probably related closely to the *R. argutus* group of eastern blackberries.

Buchanan, T. S. 1938. *See* **Pierson, R. K., and Buchanan, T. S.**

195. Bunyard, E. A. 1917. The history and development of the red currant. *J. roy. hort. Soc.*, **42**, pp. 260-70.
The three species, *Ribes rubrum*, *R. petraeum*, and *R. vulgare*, which have contributed to the red currant are described and illustrated, Janczewski being taken as the authority.

The red currant was unknown to the Greeks and Romans. It was first mentioned in a German MS. of the early fifteenth century and the plant was illustrated in the 'Mainz Herbarius' of 1484, though most writers attribute the first record to Ruellius (1536). In 1542 it appears that only one variety was grown—*R. vulgare*. In 1561 Konrad Gesner found a bush of *R. petraeum* near Berne and this species was introduced into England about 1620.

The original Red Dutch currant of the late seventeenth century was a descendant of *R. petraeum* and is distinct from the present Red Dutch (*R. vulgare*). On the Continent a Dutch currant is found which is probably the original Red Dutch, and this is known in England as Prince Albert, Rivers Late Red, etc.—true descendants of *R. petraeum*.

Little is known about the introduction of *R. rubrum*, but Raby Castle, raised about 1820, is a pure descendant of *R. rubrum* var. *pubescens*.

The section called *macrocarpum* [*R. vulgare macrocarpum*] of which Versailles, Cherry, and Fay's Prolific are representatives, came from an

importation made from Italy in 1840 by M. Seneclause of Bourg-Argental, France.

Recent additions of special interest are *R. koehneanum* (*R. multiflorum* × *R. vulgare*), which often has 35-40 fruits per strig, and *R. futurum* which has dull brownish-red fruit of mild agreeable flavour.

196. Bunyard, E. A. 1917. A revision of the red currants. *Gdnrs' Chron.*, **62,** pp. 205-6, 217, 232, 237.

Modern red currants derive from *Ribes vulgare*, *R. rubrum* and *R. petraeum*. *R. vulgare* has very open, flat flowers, green, with or without a red eye, and with a fleshy ring round the pistil. This ring serves to separate all derivatives and even hybrids of *vulgare*. The flowers and fruit hang downward and the foliage is generally rather thin, yellowish and almost hairless. *R. rubrum* varieties have bell-shaped flowers without the fleshy ring, and these are held horizontally. The foliage has more substance than that of *vulgare* and is generally densely hairy beneath. The fruits are on stiff wiry strigs. Raby Castle is a true *rubrum*. *R. petraeum* has given few varieties (Prince Albert and the Seedless Red Currant are typical), they have stout bullate leaves, red shoots, claret red flowers, and are late starting and ripening.

Raby Castle Group

These varieties show the influence of *R. rubrum pubescens* very strongly. The soft downy leaves are characteristic.

Detailed descriptions of Raby Castle, which originated prior to 1860, and of Houghton Castle (introduced *c.* 1820) are given. Houghton Castle, by its ring round the pistil, indicates its descent from *rubrum* × *vulgare*.

Versailles Group

This group includes the descendants of *R. macrocarpum*, probably a large form of *R. vulgare*. All possess very stout shoots which break off easily, thick milky-green leaves, and buds that are apt to go 'blind'. Nearly all the largest fruited sorts belong to this group.

Detailed descriptions are given of Versailles (syns. Belle Versailles, La Versaillaise, Eclipse, Magnum Bonum), Cherry (syn. Cerise), Fay's Prolific (syn. Walker's), Rouge de Boulogne (syn. Grosse Rothe von Boulogne), Red Cross, North Star, Comet, Perfection, and Wilder.

Versailles was raised about 1835 by M. Bertin of Versailles; Cherry was sent from Italy about 1840; Fay's Prolific was raised by Lincoln Fay of Chatauqua, New York, in 1868; Red Cross was raised by Jacob Moore of New York from Cherry × White Grape; North Star is an accidental seedling introduced by the Jewell Nursery Co., Minnesota; Perfection was introduced *c.* 1912, it is Fay's Prolific × White Grape (quite distinct from Laxton's Perfection); Wilder arose as a seedling of Versailles raised by E. Y. Tear of Indiana.

Gondouin Group

This group contains the descendants of *R. petraeum*. The stout wood, long buds, red campanulate flowers, and the stout coriaceous leaves render them easily distinguishable. The group includes Gondouin (syn. Bridgeford Red), raised by M. Gondouin at St. Cloud from a hybrid between *petraeum* and *vulgare*; Prince Albert (syn. Rivers' Late Red, German Sour, Knight's and Holländische Rote, Ruhm von Haarlem, and Verrieres Rouge), has been grown for some 200 years, it is considered by Janczewski to be a hybrid between *petraeum* and *vulgare*; Seedless Red

(syn. Kernlose) was found by Herr Petzold in Hessen, it is truly seedless. All these varieties are described in detail.

Scotch Group

These varieties, descended from *R. rubrum*, have bell-shaped flowers more or less tinged with red and held at right angles to the stem, stiff wiry rachis, and stiff upward-folding foliage. The group includes Scotch (syn. Millearn Red, London Market, London Red, Fowler's); La Constante; Moore's Ruby; and Chiswick Red. The origin of these varieties is unknown.

Dutch Group

These varieties have flowers of the *vulgare* type and large leaves, usually pea-green in colour. They include Dutch (syn. Old Dutch, Red Champagne, Goliath); Utrecht; Laxton's Perfection, introduced in 1910—possibly a cross between the Dutch type and Raby Castle; and Skinner's Early.

Varieties outside the Groups

Victoria (syn. Wilson's Long Bunch, Langtraubige); La Turinoise; and Fertility (syn. Le Fertile).

197. Bunyard, E. A. 1921. A revision of the red currants. *J. Pomol.*, **2,** pp. 38-55.

This paper covers the same field as the preceding one.

198. Bunyard, E. A. 1922. An introductory note on the history and development of the raspberry. *J. Pomol.*, **3,** pp. 5-6.

A brief historical note covering the early Greek writers to the present day.

199. Bunyard, E. A. 1923. Notes on a trial of gooseberries. *J. Pomol.*, **3,** pp. 148-52.

A system of classification by colour is given, based on a survey of a collection of some 250 varieties.

Green varieties

The Ocean Group.—Deep sea green with no yellow tinge; the largest are Telegraph, Greenock, Overall, and Ocean; vigour is rather lacking.

Matchless Group.—Green with cloudy white; the best are Thumper, Galopin, Union Green, and Matchless.

Alma Group.—Greenish white (decidedly more white than the Matchless group); the main varieties are Alma, Plunder, Postman, and White Swan.

Surprise Group.—Pale yellow green, slightly transparent; the principal varieties are Philip I, Random Green, Shiner, Surprise, Bang Europe, and British Queen.

Whitesmith Group.—Pale green with marked down giving an effect of bloom: Whitesmith, Lancer, Chautauqua, Wellington Glory, White Lion, Fearless, Jolly Angler, Smith's Nonpareil, Fairy, and Progress.

White varieties

Careless Group.—Careless, Mitre, Postman, White Eagle, Tally Ho, Sir George Brown, and Transparent. The latter is rather more green and forms a link with the greenish whites of the Alma group.

Yellow varieties

Catharina Group.—Golden yellow varieties: Catharina, Cousen's Seedling, Mount Pleasant, Golden Lion, and Peru.

Early Sulphur and Golden Gem deserve separate classes for colour.

Leveller Group.—Yellowish green varieties: Leveller, High Sheriff, Railway, Trumpeter, Mount Pleasant, Pretty Boy, and Lady Popham.

Leader Group.—Dull olive yellow: Coiner, Ringer, Lord Scarborough, Lord Rancliffe, Drill, Independent, and Thatcher.

Gunner Group.—Dull dark yellow: Gunner (the largest fruit in the group), Rambullion, Huntingdon Lass, and Yellow Ball.

Red varieties

Small Reds.—Red Rough, Red Champagne, and Keen's Seedling.

Medium Reds (Whinham's Group).—Whinham's, Lancashire Lad, May Duke, Rifleman, Flixtonia, Collie's Lane, Prince Regent, Crown Prince, and Lion's Provider.

Large Reds (London Group).—Napoleon le Grand, Bobby, Foreman, Eskender Bey, Dean Swift, Red Robin, Duke of Sutherland, Speedwell, Falstaff, Beauty, Lord Audeley, Slaughterman, Highlander, and Sportsman.

200. Bunyard, E. A. 1925. A handbook of hardy fruits. Stone and bush fruits, nuts, etc. John Murray, London, 258 pp.

201. Burkholder, W. H. 1917. The anthracnose disease of the raspberry and related plants. *Bull. Cornell agric. Exp. Sta.*, **395,** pp. 155-83.

Anthracnose, *Plectodiscella* [*Elsinoë*] *veneta*, attacks red, purple, and black raspberries, blackberry, eastern and western dewberry (*R. villosus* Ait. and *R. vitifolius* Cham. and Schlecht.), cloudberry (*R. chamaemorus* L.) and loganberry.

The black raspberry (*R. occidentalis* L.) is the most susceptible species, while commercial and wild forms of the American red raspberry show marked resistance. The purple raspberry inherits the susceptibility of its *R. occidentalis* parent. Hoosier black raspberry and Cuthbert red raspberry are held to be particularly resistant.

202. Butterfield, H. M. 1928. The origin of certain thornless blackberries and dewberries. *J. Hered.*, **19,** pp. 135-7.

Cory Thornless (Thornless Mammoth), from a thornless cane of Mammoth blackberry found by Charles Beede in 1908, comes true from rooted tips but not from root cuttings.

The Austin Thornless dewberry, found by Mrs. S. M. Austin, was named in 1917. It is reported to be a chance seedling of Austin, but may be a thornless sport; it breeds true. Very vigorous canes from the base of the plant may have prickles when young but these soon disappear. Burbank named two seedlings from Austin Thornless: Santa Rosa and Sebastopol.

Burbank Thornless may have been derived from *Rubus ulmifolius* var. *inermis* of Europe; there are similar thornless wild blackberries near Baghdad.

H. Ness recorded that one race of seedlings from McDonald blackberry gave about 50% of thornless plants in each generation.

Cory Thornless × Austin Thornless gave about 25% of thornless seedlings.

Butterfield, H. M. 1951. *See* **Baker, R. E., and Butterfield, H. M.**

203. Cadman, C. H., and Hill, A. R. 1947. Aphid vectors of European raspberry viruses. *Nature, Lond.*, **160,** pp. 837-8.

Amphorophora rubi Kalt. was found to transmit mosaic 2, and *Aphis idaei* V. d. G. to transmit curly dwarf from Lloyd George to Norfolk Giant.

204. Cadman, C. H. 1948. Some impressions of New Zealand raspberry growing. *Rep. E. Malling Res. Sta. for 1947*, pp. 173-7.

Great American and Red Antwerp are grown for jam; Fillbasket (syn. Superlative) is grown for the fresh fruit trade, and Lloyd George is found to a limited extent. Apparently none of the American or European aphid vectors of raspberry virus diseases occurs in New Zealand.

Cadman, C. H. 1949. *See* **Harris, R. V.,** and **Cadman, C. H.**

205. Cadman, C. H. 1950. Control of raspberry cane spot in Scotland. *Scot. Agric.*, **29,** pp. 220-6.

Four seasons' records show that the varieties most resistant to *Elsinoë veneta* are St. Walfried, Newburgh, Promise, and Enterprise (in descending order). Malling M, Jewel, and Lloyd George may at times be severely attacked, whilst Notable, Norfolk Giant, and Landmark (in ascending order) are the most susceptible of present-day varieties.

206. Cadman, C. H. 1951. Studies in *Rubus* virus diseases. I. A latent virus of Norfolk Giant. *Ann. appl. Biol.*, **38,** pp. 801-11.

Norfolk Giant (L234) is infected with a virus transmissible by *Amphorophora rubi* after short feeding periods on infected plants and persisting for 4-18½ hrs. in the aphid. This virus, carried without symptoms by Norfolk Giant and Baumforth B, causes necrosis on *Rubus henryi* and mosaic on *R. saxatilis*, *R. occidentalis* (var. Cumberland), and the red raspberries Chartham, Landmark, St. Walfried, and Malling K. The virus is present in some commercial stocks of Baumforth B, Burnetholm, Enterprise, Notable, and Promise. The name 'raspberry leaf mottle' is proposed.

Scions of Landmark grafted to L234 Norfolk Giant developed symptoms in 6 weeks; 5 plants of *R. henryi* grafted with L234 Norfolk Giant developed necrosis in just over 3 weeks.

207. Cadman, C. H., and **Harris, R. V. 1951.** Raspberry virus diseases: a survey of recent work. *Rep. E. Malling Res. Sta. for 1950*, pp. 127-30.

The existence of two groups of virus diseases is confirmed. Group I designates those distinct diseases which appear to be of single virus origin and which produce visible mosaic symptoms on all European varieties of *R. idaeus* examined. Group II includes diseases that are expressed only by a few of such varieties and are carried without visible symptoms by others.

Mild vein chlorosis was present in all 'healthy' stocks of Baumforth B examined. Medium vein chlorosis is commonly present in commercial stocks of all European varieties; it is transmissible by *Aphis idaei*. Severe vein chlorosis, first found on Norfolk Giant, has since been identified on Lloyd George and other varieties.

Vein banding mosaic is thought to be the mosaic 1 of Harris.

Mild and severe yellows appear to be related strains of one virus, other strains of which are probably responsible for the yellows diseases of Devon and certain other varieties.

Leaf curl, characterized by severe leaf curling and necrosis on Norfolk Giant and Baumforth B, produces yellow blotching and other forms of leaf chlorosis on other varieties. The vector is unknown.

Rubus stunt causes sterility, dwarfing, and proliferation of canes.

Mosaic 2 is characterized by a leaf pattern of irregularly distributed, sharply defined and incised chlorotic spots not masked by warm weather.

Two types, mild and severe, have been identified on Norfolk Giant and Baumforth B, each probably being of single virus origin though their interrelations are unknown. Burnetholm is the only other expressive European variety found, the majority being symptomless carriers. Other latent mosaic diseases, producing necrosis on *Rubus henryi*, have been found on otherwise healthy stocks of N.Z. Lloyd George, St. Walfried, and Landmark.

Curly dwarf: infected Baumforth B shows severe leaf curling and proliferation of canes.

Bushy dwarf is carried without symptoms by Norfolk Giant but induces dwarfing of canes, down-curling of leaves and diffuse chlorosis in Lloyd George.

Degenerate stocks of Lloyd George have consistently proved to contain a combination of mosaic 2, bushy dwarf, and yellows; this combination appears to have no effect on Promise or Newburgh. Commercial stocks of Enterprise and Jewel, though vigorous, contain a mixture of severe mosaic 2, leaf mottle, and probably mild yellows. This combination produces severe effects on Norfolk Giant (sensitive to mosaic 2) and Landmark (sensitive to leaf mottle).

208. Cadman, C. H., and **Wood, C. A. 1951.** Raspberries in Scotland. *Sci. Hort.*, **10,** pp. 24-33, and *Rep. E. Malling Res. Sta. for 1950*, pp. 203-8.

A popular survey which deals with: Lloyd George, a general purpose variety, which, though susceptible to late spring frosts, can recover by forming late-fruiting secondary laterals. Norfolk Giant, a late, frost-escaping variety which is favoured for canning and quick freezing; it is very susceptible to cane spot. St. Walfried, an early to mid-season variety which is unduly susceptible to spring frosts; the fruit is suitable for jam but too soft for basketing; it is highly resistant to cane spot. Newburgh, a mid- to late-season type favoured for the dessert trade, is too crumbly for canning or quick freezing; it appears to be highly virus tolerant; hangs well. Burnetholm, an early to mid-season type of good dessert quality; hangs well. Promise, an early type with very large berries, is less frost susceptible than Lloyd George or St. Walfried; the fruit is rather soft for the dessert trade and it is poor for canning and quick freezing. Landmark is a late type (though not as late as Norfolk Giant) which yields an outstandingly heavy crop; the fruit is soft, acid, difficult to plug, and is apt to spoil in wet weather; it is generally suitable only for jam; the canes are rather thorny. Notable, a second early to mid-season type, is of only moderate quality for canning and quick freezing. Enterprise, a mid- to late-season variety rather sparing in cane production, is of good dessert quality and is suitable for canning and fairly satisfactory for quick freezing. Jewel is an early to mid-season variety and almost spine free; it is favourably reported on for canning and quick freezing.

209. Cadman, C. H. 1952. Studies in *Rubus* virus diseases. II. Three types of vein chlorosis of raspberries. *Ann. appl. Biol.*, **39,** pp. 61-8.

The three diseases described commonly occur in commercial stocks of raspberries and are caused by Group I viruses (Cadman and Harris, 1951). The symptoms of all three are similar and are described by the names 'mild', 'moderate', and 'severe vein chlorosis'. All 'healthy' plants of Baumforth B appear to carry mild vein chlorosis. Moderate vein chlorosis commonly occurs in commercial stocks of Norfolk Giant and

produces vein chlorosis symptoms on European varieties; no graft transmission was obtained to the American varieties Newburgh, Cuthbert, and Viking. Severe vein chlorosis, first found on Norfolk Giant, was graft transmitted to several European varieties, but despite repeated attempts this disease has not been transmitted to Baumforth B or to the North American varieties Newburgh and Cuthbert.

The evidence, suggesting that the three diseases are caused by related strains of one virus, is discussed.

210. Cadman, C. H. 1952. Studies in *Rubus* virus diseases. III. A veinbanding disease of raspberries. *Ann. appl. Biol.*, **39**, pp. 69-77.

A chlorotic veinbanding disease of raspberries common in Britain is due to a single virus transmissible by *Amphorophora rubi* Kalt. after feeding periods of 18 hours or less and persists in the vector for not more than 24 hrs. The virus is considered to be identical with mosaic 1 of Harris (1940).

Vein banding symptoms, masked in hot weather, appeared on the leaves of a wide range of European and North American varieties when grafted to an infector. *R. saxatilis* infected by grafting, shows severe interveinal chlorosis and necrosis of stolon tips. *R. occidentalis* and a purple raspberry seedling (*R. occidentalis* × *R. idaeus*) also showed symptoms.

Symptoms on North American varieties are analogous to those of the red raspberry mosaic of American authors. The names 'veinbanding disease' and 'raspberry veinbanding virus' are proposed.

211. Cadman, C. H. 1952. Studies in *Rubus* virus diseases. IV. Yellows diseases of raspberries. *Ann. appl. Biol.*, **39**, pp. 495-500.

Yellows diseases are common in certain commercial raspberry varieties, including Devon (no longer grown owing to the disease), Bath's Perfection (syn. Marlboro), Lloyd George, St. Walfried, and Norfolk Giant.

The condition proved graft transmissible. Two different diseases, named 'mild' and 'severe yellows', have been distinguished on Norfolk Giant, but there are probably others, including 'Devon chlorosis'. Yellows diseases are probably economically important in certain varieties, notably Lloyd George.

212. Cadman, C. H. 1952. Studies in *Rubus* virus diseases. V. Experiments in the analysis of Lloyd George decline. *Ann. appl. Biol.*, **39**, pp. 501-8.

Degenerate plants of Lloyd George are usually infected with a complex of viruses that cause mosaic 2 (Harris, 1940) on Baumforth B and Norfolk Giant. This complex comprises mild yellows and at least two other viruses, one of which, raspberry leaf spot, is transmitted by *Amphorophora rubi*. This virus produces characteristic symptoms on Baumforth B, Burnetholm, and Norfolk Giant, and is carried without symptoms by St. Walfried, Lloyd George, and many other European and N. American varieties. The symptoms are translucent, angular, chlorotic spots which often coalesce, resulting in curling, twisting, and asymmetric development of the lamina; canes may be stunted. Both mild yellows and leaf spot seem to be only subsidiary causes of raspberry degeneration.

213. Cadman, C. H., and Harris, R. V. 1952. Leaf Curl, a virus disease of raspberries in Scotland. *J. hort. Sci.*, **27**, pp. 201-11.

The symptoms of a graft-transmissible necrotic, leaf-curling disease of

Norfolk Giant are described. The leaf curl virus causes necrotic leaf curling in Baumforth B, a lethal yellow blotch in Preussen, Enterprise, Jewel, and Notable, and a non-lethal chlorosis in Lloyd George, St. Walfried and Promise. Temporary masking of symptoms on Norfolk Giant and Baumforth B under warm conditions has been observed. No insect vector has yet been found.

214. Cadman, C. H., and **Harris, R. V. 1952.** A lethal virus disease of Lloyd George raspberry in Scotland. *J. hort. Sci.*, **27,** pp. 212-14.

A lethal leaf blotching disease of Lloyd George and Burnetholm is shown to be graft transmissible and has been named 'yellow blotch'. The virus produces mosaic symptoms of a hitherto unrecorded type on Norfolk Giant, and non-lethal leaf curling and mosaic on Baumforth B, St. Walfried, and Promise. Yellow blotch is transmitted by *Amphorophora rubi*.

215. Cadman, C. H. 1954. Studies in *Rubus* virus diseases. VI. Aphid transmission of raspberry leaf mottle virus. *Ann. appl. Biol.*, **41,** pp. 207-14.

Raspberry leaf mottle is acquired by *Amphorophora rubi* in feeding periods of $\frac{1}{2}$-2 hours.

On an average, 1 in 20 viruliferous aphids transmitted virus when placed on *Rubus occidentalis*. Rarely more than 50% of the seedlings became infected, probably due mainly to variation in plant susceptibility.

Young infected leaves were a considerably more efficient source of infection than older ones, and significantly more efficient than senescing leaves.

216. Cadman, C. H. 1954. Department of plant pathology. *Rep. Scot. hort. Res. Inst. for 1953-4*, pp. 17-19.

An extract of raspberry leaves taken from plants infected with raspberry leaf curl disease produced ringspot symptoms on certain herbaceous plants. Inoculation of Norfolk Giant seedlings with sap from the herbaceous host produced typical leaf curl symptoms. This is the first time that any virus affecting raspberries has proved to be sap transmissible.

Lloyd George and Jewel are more susceptible to veinbanding virus than Promise, Exploit, and Norfolk Giant, but spread in Lloyd George in the field is slow.

Seeds of red raspberry will not germinate unless stored for 4-6 weeks at 25° C. and subsequently held for 7-8 weeks at 0° C. Germination is increased by soaking the freshly harvested seeds for 4 days in 1% calcium hypochlorite solution. The optimum combination of treatments, however, gave a maximum percentage germination of only 60-70.

217. Cadman, C. H. 1955. Plant pathology. *Rep. Scot. hort. Res. Inst. for 1954-5*, pp. 24-6.

Ringspot viruses have been isolated from Exploit grown in Devon and from Promise grown near Bristol, as well as from plants with leaf curl symptoms growing in 12 different places in Angus and Perthshire. Leaf curl symptoms in plants of Jewel, Norfolk Giant and other sensitive varieties are associated with many differing ringspot viruses and different groups of viruses occur in different localities. The viruses may be spread by some form of soil transmission.

Raspberry varieties appear to differ greatly in their susceptibility to

leaf spot, one of the components of the virus complex causing decline of Lloyd George. Exploit and Lloyd George appeared most susceptible, Promise intermediate, and Landmark and Norfolk Giant least susceptible.

Cairns, H. 1937. *See* **Saunderson, W. R., and Cairns, H.**

Cameron, D. F. 1951. *See* **Ferguson, W., Spangelo, L. P., and Cameron, D. F.**

218. Camp, A. F. 1929. Horticulture. *Rep. Fla agric. Exp. Sta.*, pp. 63-7.
The Californian blackberry, Advance, is apparently immune to the double-blossom disease.

219. Carrick, D. B. 1920. Resistance of the roots of some fruit species to low temperature. *Mem. Cornell agric. Exp. Sta.*, **36**, pp. 613-61.
Roots of Downing gooseberry were more resistant to low temperature than those of Wilder currant. No significant differences were seen between the hardiness of blackberry and red raspberry roots.

220. Čemodanova, E. V. 1948. (Measures to control rust in the gooseberry and currants.) *Sad i Ogorod* (Fruit and Veg. Gdns) *No. 5*, pp. 28-9. (From *Plant Breed. Abstr.*, **19**, p. 394.)
The study of varietal susceptibility to rust in the gooseberry in the Leningrad Province has established Avenarius as highly susceptible (45·7%) and Industria as susceptible (30·3%). The following were moderately susceptible: Columbus (23·4%), Sejanec Spirina (22·6%), Triumph (21·1%), Langeĭ Gendž (20·7%), Želenyi Butyločnyĭ (19·7%), Goliath (18·8%), Crown Bob (13·8%), Ranii Želtyi (11·8%), Angliĭskiĭ Želtyi (8·7%), and Venera (7·8%). Moderately resistant varieties included Želenyĭ Genza (4·0%), Barhatnyĭ (4·0%), and Vinogradnyĭ (3·7%). Houghton, Pearl, Karri, Puermon, and Jocelyn were resistant.

221. Chamberlain, G. C. 1938. Yellow blotch-curl: a new virus disease of the red raspberry in Ontario. *Canad. J. Res.* (*C*), **16**, p. 118.
Transmission by patch grafting showed that varieties differed in susceptibility, Chief and Cuthbert being least affected while Latham and Herbert proved distinctly susceptible.

222. Chamberlain, G. C. 1941. A necrotic 'fern-leaf' mosaic of raspberry. *Sci. Agric.*, **22**, pp. 119-24. (Condensed from *Exp. Sta. Rec.*, **87**, p. 241.)
The author describes a virus-induced necrotic spotting of the leaf, marked retardation of foliation, and an irregular blotch and spot type of mottle, which was readily transmitted to *Rubus* spp. by panel-type patch grafting but not by the insects tested. Cuthbert and Viking proved most susceptible.

Chamberlain, G. C. 1944. *See* **Berkeley, G. H., and Chamberlain, G. C.**

223. Chambers, J. 1954. Heat therapy of virus infected raspberries. *Nature, Lond.*, **173**, pp. 595-6.

224. Chambers, J. 1955. Production of virus-free raspberries. *Rep. Scot. hort. Res. Inst. for 1954-5*, pp. 25-6.

225. Charlet, A., Magnel, L., and Maréchal, A. 1928. (Contribution to the study of the distribution of *Rubus* in Belgium.) *Bull. Soc. roy. Bot. Belg.*, **61.**

226. Cherry, W. F. 1932. Studies on the effect of chemical fertilizers upon growth and fruit production of the black raspberry. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 176-9.
There was a definite correlation between yield and size of berries and diameter of canes.

Childs, T. W. 1937. *See* **Mielke, J. L., Childs, T. W., and Lachmund, H. G.**

227. Chomisury, N. 1927. (The germinability and cytology of pollen of some varieties of *Prunus* and *Rubus*.) *Angew. Bot.*, **9,** pp. 626-36. (Condensed from *Biol. Abstr.*, **4,** p. 1517.)
Of 5, 10, and 15% sugar solutions, 15% gave the best germination. Almost all pollens gave better germination in pure sugar solution than in gelatine-sugar media, but tube growth was longer in the latter. Pollen of certain varieties germinated better in media containing stigmas of another variety. Blackberries and raspberries were self-fertile, raspberries were cross fertile, and a raspberry-logan cross was fertile. Chromosome counts showed the following haploid numbers: Lawton 14, raspberries 7 and 14, *Rubus phoenicolasius* 7, with normal behaviour of chromosomes in all. The loganberry has 21 haploid chromosomes with normal behaviour except for some lagging in metaphase II.

228. Christ, E. G. 1952. Strawberry and blackberry released for 1953 planting. *Hort. News N.J.*, **33,** pp. 2558, 2567. (From *Plant Breed. Abstr.*, **23,** p. 316.)
The blackberry New Jersey 76 (Evergreen × Eldorado) has been developed at the New Jersey Agricultural Experiment Station.

229. Christen, H. R. 1950. (Investigations on the embryology of pseudogamic and sexual *Rubus* species.) *Ber. schweiz. bot. Ges.*, **60,** pp. 153-98. (From *Plant Breed. Abstr.*, **22,** p. 447.)
Existing evidence on reproduction in *Rubus* species is briefly considered with reference to the occurrence of pseudogamous and sexual reproduction. As a contribution to the classification of the process of apomixis and of the relevant terminology the present detailed study of the structure and development of the archespore and embryo sac was undertaken.

In the course of the work, the chromosome numbers of eight species of *Rubus* were determined: *R. caesius*, *R. suberectus*, *R. bifrons*, *R. vestitus* and *R. bregutiensis* proved to be tetraploid (2n=28) while *R. mercieri* and *R. thyrsoides* had 2n=21, and *R. tomentosus* 2n=14. The occurrence of apospory and diplospory in the various *Rubus* species is discussed with special reference to the essential difference between these two types of development.

In the author's opinion unreduced egg cells capable of fertilization probably occur in *Rubus*, and crosses may therefore produce three types of offspring, resulting respectively from unfertilized eggs, fertilization of haploid eggs, and fertilization of unreduced eggs.

230. Christen, H. R. 1953. (The embryology of *Rubus idaeus* and of hybrids between *Rubus caesius* and *Rubus idaeus*.) *Z. Indukt. Abstamm. -u. VererbLehre*, **84,** pp. 454-61. (Condensed from *Plant Breed. Abstr.*, **23,** p. 629.)
Three hybrids all had 2n=21 chromosomes; all varieties of *R. idaeus* examined had 2n=14 and displayed regular meiosis and embryo-sac development similar to that already observed in the sexual species *R. tomentosus*. The early archespore development of the hybrids was also normal, but certain irregularities such as undifferentiated nucelli were observed later, and at meiosis 9_{ii} and 1_{iii} were often present, together with certain other irregularities. The majority of embryo sacs were reduced but occasional diplosporous embryo sacs occurred and only these seemed to be functional. The tendency to diplospory has evidently been transmitted to the hybrids from *R. caesius* and seems to be only partially recessive to the gene D for sexuality.

231. Christensen, J. R. 1947. Root studies. XI. Raspberry root systems. *J. Pomol.*, **23,** pp. 218-26.
Roots of Norfolk Giant, Newburgh, and St. Walfried are described and illustrated. The percentage root distribution in depth was closely similar for all three varieties. The maximum root length recorded was 180 cm. Suckers may arise from great depths, underlining the importance of wide separation of plants in variety trials.

232. Cicin, N. V. 1954. (Distant hybridization in plants.) *Gosudarstvennoe Izdateljstvo Seljskohozjaistvennoi Literatury, Moscow*, pp. 200-34. (Condensed from *Plant Breed. Abstr.*, **26,** p. 43.)
Three F_1 hybrids of *Rubus flagellaris* var. *roribaccus* (Lucretia, $6x$) × *R. saxatilis* ($4x$) were pentaploid. Two surviving plants were annual in habit.

233. Clark, J. H. 1935. Some new varieties of small fruits and grapes. *N.J. hort. Soc. News*, **16,** pp. 700-1, 709.
New varieties of raspberries, dewberries, blackberries, currants, and gooseberries tested at the New Jersey Experiment Station are reported on.

Clark, J. H. 1939. *See* **Darrow, G. M.,** and **Clark, J. H.**

Close, A. W. 1941. *See* **Joley, L. E.,** and **Close, A. W.**

234. Close, C. P. 1898. Spraying in 1897 to prevent gooseberry mildew. *Bull. N.Y. St. agric. Exp. Sta.*, **133,** pp. 489-500.
English varieties and their seedlings appear more subject to mildew than American varieties.

Clothier, G. E. 1935. *See* **Spinks, G. T.,** and **Clothier, G. E.**

235. Cobin, M., and **Ruehle, G. D. 1950.** Sub-tropical crops of minor economic importance. *Rep. Fla agric. Exp. Sta. 1949-1950*, pp. 231-3.
Rubus albescens Roxb. (=*R. lasiocarpus* Smith), the Mysore Raspberry, shows promise of being a suitable black raspberry for home planting in Dade County. Its vigour, yield and apparent disease resistance offer opportunities for hybridization. Seeds of crosses of *R. albescens* × Sunrise, Latham, and Taylor have been planted.

236. Coe, F. M. 1944. Red raspberry varieties for freezing, local market, and home use. *Fm Home Sci. Utah*, **5** (2), pp. 3, 11. (From *Plant Breed Abstr.*, **15**, p. 165.)

Taylor has large, high quality fruits which retain their superior flavour after freezing; Newburgh bears heavy fruits which weigh down the canes and facilitate picking; Washington has high quality fruits and is more winter hardy than Cuthbert; Indian Summer is an 'ever-bearing' raspberry with larger fruits than Ranere; Sodus is a heterotic purple-cane variety with larger, dull, purplish-red berries; Marcy has large, dark red, high flavoured berries but is susceptible to winter killing.

237. Colby, A. S. 1923. Small fruit experiments at the Urbana Station. *Trans. Ill. St. hort. Soc.*, **57**, pp. 144-52.

Anthracnose of black raspberries (*Gloeosporium* [*Elsinoë*] *venetum*) is controlled by two sprays of lime-sulphur (during the dormant period and a week before the blossoming). The Quillen black raspberry is highly resistant, as also are purple raspberries in general.

238. Colby, A. S., and **Anderson, H. W. 1926.** Diseases of brambles in Illinois and their control. *Circ. Ill. agric. Exp. Sta.*, **305**, 20 pp.

Plectodiscella [*Elsinoë*] *veneta*: Quillen is practically immune; Cumberland, Plum Farmer, Gregg, Munger, Older, and Honey Sweet are moderately susceptible; Scarff and Earhart are highly susceptible.

Leptosphaeria coniothyrium affects only red and black raspberries (especially the latter) in Illinois.

Pseudomonas tumefaciens often causes 10-50% loss of crop in Illinois. Red raspberries, except the everbearing Ranere (St. Regis), are particularly susceptible.

Orange rust (*Gymnoconia interstitialis*) occurs principally on blackberries and dewberries, but black raspberries are sometimes affected. Snyder and Eldorado are resistant.

Leaf curl occurs chiefly on red raspberries and on Scarff, Honey Sweet, and Cumberland. Mosaic is found principally on red and purple raspberries, Cuthbert, King, Perfection, and Marlboro being particularly susceptible, while Redpath (a strain of Latham) is resistant.

239. Colby, A. S. 1927. Notes on self-fertility of some gooseberry varieties. *Proc. Amer. Soc. hort. Sci.*, **23**, pp. 138-40.

None of the gooseberries under test failed to fruit when insects were excluded. Glenndale bore as large fruits with as many seeds from self-pollination as from cross pollination. A number of hybrid varieties showed 4-12 more seeds per berry when insects were not excluded; Whitesmith and Triumph gave corresponding increases but these are not considered significant. *Ribes gracile* yielded three seeds per berry when bagged and 41 when open pollinated.

240. Colby, A. S. 1928. The inheritance of anthracnose resistance in certain raspberry hybrids. *J. Hered.*, **19**, pp. 377-82.

Anthracnose is a limiting factor in many areas in raspberry growing, especially with black varieties. The following black varieties were susceptible: Cumberland, Plum Farmer, Black Pearl, Honey Sweet, Munger, Gregg, Earhart, Older, and Conrath. Quillen showed partial resistance. Plants were classified into four groups: free from infection, slight, medium, and heavy infection. Quillen itself showed the following percentages in

these four groups respectively: 22, 65, 13, 0, whereas its self-bred progeny (only 23 plants) showed 52, 44, 4, 0. Plum Farmer showed 0, 0, 31, 69 (only 16 plants) whereas its selfed progeny showed 0, 18, 30, 52 (128 plants). Royal Purple, with 96% of its plants showing slight to medium infection, showed a similar distribution (99%) in its self-bred progeny, but June with 82% with 'free' to slight infection gave a hybrid, June × Plum Farmer, with 100% heavy infection, and a reciprocal with 0, 16, 26, and 58% respectively, in the four groups.

Crosses were successfully made between black and red raspberries in both directions.

241. Colby, A. S. 1931. Some raspberry varieties being used as parents in breeding. *Proc. Amer. Soc. hort. Sci.*, **27,** pp. 422-4.

Quillen was by far the most useful parent. Its progeny, comprising over 600 individuals showed nearly 50% of plants classed as very good. Quillen itself shows high anthracnose resistance. The Honey Sweet-Plum Farmer cross gave individuals more resistant than either parent and with excellent fruiting characters. A few Quillen × Golden Queen seedlings seem to have some value as purples. Though Golden Queen is not hardy, a high winter resistance appeared in this group of hybrids.

242. Colby, A. S. 1933. The small fruit variety question in Illinois. *Trans. Ill. Acad. Sci.*, **25,** pp. 116-18.

Columbus × Carrie and Poorman × Transparent gooseberries have given progenies very promising in fruit and plant characteristics, while Glenndale and Carrie selfed produced a number of seedlings superior to the parents.

243. Colby, A. S. 1934. Size inheritance in gooseberry fruits. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 105-7.

Most of the commercial varieties of gooseberry are probably hybrids between *Ribes hirtellum* and the western European species, *R. grossularia.*

The size of fruit of the progeny of a number of varieties selfed and crossed was grouped into four classes. Large fruits were obtained only in Carrie × Poorman and Transparent × Poorman crosses, and in the progeny from selfed Glenndale, and they represented only 5·2, 2·4, and 2·0% respectively. The results indicate that Poorman carries the greatest proportion of factors for large fruit size. Many of the large fruited seedlings are also promising in respect of spinelessness and resistance to leaf diseases.

244. Colby, A. S. 1935. Inheritance of gooseberry leaf infection. *Proc. Amer. Soc. hort. Sci.*, **32,** pp. 397-9.

Transparent, Rideau, Como, and to a lesser extent Carrie, carry factors for resistance to anthracnose and leaf spot, while Poorman, Glenndale, Oregon Champion, Downing, and Minnesota No. 96 appear least promising from this point of view. In crosses between Transparent and Rideau, 30% of the progeny showed only light infection, similarly 31·5% of the self-bred progeny of Como showed only light infection. Seedlings combining high resistance with large fruit and spinelessness were obtained.

245. Colby, A. S. 1936. The inheritance of suckering and tip layering in purple raspberry seedlings. *Proc. Amer. Soc. hort. Sci.*, **33,** pp. 427-9.

While most red raspberries propagate by suckers, black raspberries

propagate by tip layers. Observations on five groups of purple raspberries derived from crossing Quillen with Golden Queen, Latham, June, Starlight, and Ranere, showed one group, Quillen × Ranere, to fail to propagate either by suckers or by tip layers. Quillen is believed homozygous for tip layering because no suckering occurred in 579 of its selfed seedlings. About 25% of the plants of the Golden Queen, Latham, and Starlight crosses suckered, suggesting 'the possibility of a simple monohybrid character'. Quillen × June yielded only 7% of suckering plants and Quillen × Ranere gave none.

246. Colby, A. S. 1940. The Brainerd blackberry. *Amer. Fruit Gr*, **60** (3), pp. 11, 35.
The Brainerd, a hybrid of Himalaya with an eastern variety (possibly Georgia Mammoth), is vigorous and has a long picking period.

247. Colby, A. S. 1940. The Brainerd blackberry in Central Illinois. *Proc. Amer. Soc. hort. Sci.*, **37**, pp. 593-6.

Colby, A. S. 1943. *See* **Roberts, O. C.,** and **Colby, A. S.**

248. Colby, A. S. 1943. Winter injury as a limiting factor in red raspberry growing. *Proc. Amer. pomol. Soc.*, **59**, pp. 125-35.

249. Colby, A. S. 1945. Plan now to eradicate raspberry anthracnose. *News Lett. Ill. St. hort. Soc. No. 2*, pp. 1-3.
Discusses selection of anthracnose resistant varieties.

Colby, A. S. 1955. *See* **Boll, H. L.,** and **Colby, A. S.**

Connors, C. H. 1913. *See* **Blake, M. A., Farley, A. J.,** and **Connors, C. H.**

250. Cooley, L. M. 1936. Wild brambles in relation to spread of virus diseases in cultivated black raspberries. *Bull. N.Y. St. agric. Exp. Sta.*, **665**, 15 pp.
In western New York State wild red raspberries are numerous and are usually infected with one or both mosaic viruses but do not show marked symptoms. They support steady populations of *Amphorophora rubi* and are an important factor in the spread of mosaic—sometimes to a distance of over 400 yards.

Other wild *Rubi*, mostly *R. allegheniensis* and *R. occidentalis*, though prevalent play no apparent part in mosaic spread. These species are rarely infected and are relatively unfavourable hosts for the vector.

Leaf curl is rare in wild brambles and its spread from wild hosts to cultivated raspberries is very slow, although the vector, *Aphis rubicola*, is common on all wild and cultivated raspberries in western New York.

Although a few streak infections were found in wild black raspberries and in blackberries, its spread from these appears to be of little importance. The vector of black raspberry streak is unknown.

251. Coville, F. V. 1925. *Grossularia echinella*, a spiny fruited gooseberry from Florida. *J. agric. Res.*, **28**, pp. 71-4.
A detailed illustrated description is given of this new species. The spininess of the fruit is the most remarkable characteristic. Of the six other species

of gooseberry native in eastern North America, *G. cynosbati*, *G. oxyacanthoides*, *G. hirtella*, *G. rotundifolia*, *G. missouriensis*, and *G. curvata*, only one, *G. cynosbati*, has spiny fruit and that species is not closely related to *G. echinella* as shown by their very different flower structure. It is only in some of the Pacific coast species such as *G. menziesii*, *G. hesperia*, and *G. hystrix* that dense spininess occurs as a fruit character; none of these species is closely related to the new species.

G. echinella is closely related to *G. curvata*, *G. missouriensis* and *G. nivea*, none of which has spiny fruit.

The new species may prove of value in breeding to extend the southern limits of gooseberry growing, since it is adapted to a climate more southerly than that of any other species.

252. Crane, M. B. 1924. Raspberries. *Rep. John Innes hort. Instn for 1923*, pp. 21-2.

The colour of fruit and spines in raspberries appear to be correlated. Superlative and Norwich Wonder both have red fruits and spines. When selfed, both gave approximately one yellow fruited plant in sixteen. This ratio could be subdivided on spine colour into 9 red spined: 6 tinged red: 1 no colour.

Sub-glabrous canes behave as a simple recessive to pubescent canes.

In selfed Superlative and Norwich Wonder families, approximately 25% of the plants have very obtuse, down-folded foliage and aborted female organs. In these and other respects they resemble *R. idaeus obtusifolius* or *R. leesii*.

253. Crane, M. B. 1927. Studies in relation to sterility in plums, cherries, apples, and raspberries. *Mem. hort. Soc. N.Y.*, **3**, pp. 119-34.

Selfing Superlative and Norwich Wonder yielded a number of seedlings with impotent pistils. These male plants bore obtuse, down-folded, undivided leaves on the fruiting canes and 3-lobed, short-petioled leaves on the young canes.

254. Crane, M. B., and **Darlington, C. D. 1927.** The origin of new forms in *Rubus*. *Genetica*, **9**, pp. 241-78. (Authors' summary.)

A number of crosses where the parents had different chromosome numbers were sterile. Three exceptions occurred, viz. (*a*) a tetraploid seedling RT4, from a cross between diploid and tetraploid blackberry species, (*b*) and (*c*) two heptaploid seedlings from a cross between a hexaploid (loganberry) and a diploid raspberry.

Genetical and cytological evidence shows that these seedlings result from the functioning of unreduced ova. Comparison of RT4 with its normally reproduced sister seedlings shows the differential effect of the extra chromosome set derived from one parent.

Amongst 490 selfed seedlings of RT4, two different types of segregation occur; one results from random assortment of the parental chromosomes modified by a tendency to allosyndesis, the other results from pure autosyndesis and is analogous with 'shift', one parental type never reappearing.

The development of the seedlings shows that stalked glands, acicles and prickles are morphologically equivalent, glands and prickles corresponding to prickles in the juvenile condition of the plant. Subsequently, stalked glands, acicles and prickles may develop side by side as in *R. thyrsiger*, or prickles alone as in *R. rusticanus*, RT4 and its seedlings.

Secondary pairing of chromosomes at meiosis in polyploid forms and the form of somatic chromosomes confirm the conclusion that the chromosome complements of all species of *Rubus* are composed of homologous sets of seven chromosomes.

Crosses of loganberry with diploid species in which normally reduced gametes have functioned (tetraploids) are infertile. They show pronounced dominance of loganberry characters.

The hexaploid constitution of the loganberry renders the question of its origin one of whether it is derived *directly* or *indirectly* from hybridization. The suggestion of its origin as an immediate raspberry-blackberry cross is supported by the new genetical and cytological evidence.

A number of other *Rubus* hybrids are described from the point of view of morphology and fertility.

Apogamy has possibly taken place in two or three of the crosses under investigation.

255. Crane, M. B., and **Lawrence, W. J. C. 1931.** Inheritance of sex, colour and hairiness in the raspberry, *Rubus idaeus* L. *J. Genet.*, **24,** pp. 243-55.

Two factors are concerned with sex: FM is hermaphrodite; Fm female; fM male; and fm neuter. Maleness and obtuse foliage are correlated. Red and tinged spined forms have red fruits, green spined forms have yellow fruits. PT gives red spines and fruits; pT tinged spines and red fruits; Ptt and ptt green spines and yellow fruits. P intensifies the colour. The spine colour of P and pt is green but Ptt fruits have a very faint tinge of red when fully mature whilst pptt fruits are a clear yellow. Hairiness (H) of the cane is dominant to sub-glabrous (h). Selfing Hh plants gave ratios approximating to 2 : 1, suggesting that HH forms are suppressed by a linked lethal.

Genetic differentiation of sex in *R. idaeus* is probably homologous with the basis of the sexual dimorphism in *R. chamaemorus*. It is suggested that this condition is one from which alternative chromosome types might originate as the result, not the cause, of sexual differentiation.

256. Crane, M. B., and **Darlington, C. D. 1932.** Chromatid segregation in tetraploid *Rubus*. *Nature, Lond.*, **129,** p. 869. (From *Plant Breed. Abstr.*, **2,** p. 164.)

Results observed are compared with those expected on the assumption of random segregation of chromosomes and the random segregation of chromatids. The results agree with the latter and differ significantly from the former hypothesis, so supporting the chiasmatype hypothesis of crossing over.

257. Crane, M. B. 1935. Blackberries, hybrid berries, and autumn-fruiting raspberries. *Cherries and Soft Fruits Conf. roy. hort. Soc., Lond.*, pp. 121-8.

The following species of European blackberries comprise valuable plant breeding material: *Rubus thyrsiger* (2n=28) in its best forms shows long pyramidal inflorescences with medium to large fruits of good flavour; it is prolific and the season extends over several weeks. *R. nitidioides* (2n=28) is heavy yielding and comparatively early; it has large, good flavoured fruits. *R. borreri* (2n=42) is early and has large fruits of good flavour. *R. laciniatus* (2n=28) (Cut-leaved or Parsley-leaved blackberry) is productive and has moderate to large sized fruit. *R. rusticanus* (2n=14) is late

ripening. It is not a desirable variety, although spineless and amber fruited forms occur. *R. schlechtendahlii* (2n=28) is a prolific bearer of good flavoured fruit. *R. calvatus* (2n=28) is early, of good flavour, and crops heavily. Edward Langley is allied to this species. *R. procerus* (2n=28) has very stout vigorous growth which is persistent, bearing fruit year after year. Himalaya Berry is of this type.

Descriptive notes are given of John Innes (2n=28) from *R. rusticanus inermis* × *R. thyrsiger*; Cory Thornless (2n=42), a periclinal bud sport from Mammoth or Lowberry; The Mahdi (2n=21), from raspberry × blackberry; Veitchberry (2n=28) from raspberry × blackberry; Bedford Giant (2n=42) derived from selfing the Veitchberry; Loganberry (2n=42); Phenomenal Berry (2n=42) from western dewberry × raspberry; and the Laxtonberry (2n=49) from Loganberry × Superlative raspberry.

Autumn-fruiting raspberries are polyploid, except Lloyd George and Queen Alexandra. Reasons are given for presuming the loganberry to have arisen from *R. ursinus* or *R. ursinus vitifolius* crossed with raspberry, the latter contributing an unreduced cell.

258. Crane, M. B., and Thomas, P. T. 1939. Segregation in asexual (apomictic) offspring in *Rubus*. *Nature, Lond.*, **143**, p. 684.

All diploid *Rubus* species examined reproduced sexually, but in polyploids reproduction may be (1) entirely sexual, (2) entirely non-sexual, apomictic, or (3) partly sexual and partly non-sexual. Segregation is not conclusive evidence of sexual reproduction. Thus *R. nitidioides* (2n=28) crossed with *R. thyrsiger* (2n=28) gave (*a*) a small proportion of sexual hybrids, (*b*) a large proportion identical with the maternal parent, *R. nitidioides*, and (*c*) a new true-breeding form with large flowers and 7-leaflet leaves which shows no trace of *R. thyrsiger*. The dioecious species *R.* [*ursinus*] *vitifolius* (2n=56) × *R. idaeus* (2n=14) gave all sexual pentaploid offspring, but *R. vitifolius* crossed with tetraploid *idaeus* gave sexual 42-chromosome plants and also a group of 56-chromosome plants, evidently of apomictic origin from *R. vitifolius*. About half these plants were female and the remainder male. Evidently the apomictic embryo arises after the first meiotic division, presumably by diploid parthenogenesis.

259. Crane, M. B. 1940. Reproductive versatility in *Rubus*. I. Morphology and inheritance. *J. Genet.*, **40**, pp. 109-18. (Author's summary.)

The reproductive behaviour of a number of species and varieties of *Rubus* has been investigated. Diploid species always behave sexually. Occasional unreduced germ cells occur and take part in fertilization, giving rise to polyploid forms.

In polyploid forms and species reproduction may be entirely sexual, entirely non-sexual or partly sexual and partly non-sexual (apomictic). Polyploid species vary in the degree to which apomixis is developed, and a particular species may show a variation in reproductive behaviour depending on the species used as male in cross pollination.

Segregation has been found to occur within non-sexual offspring. Hence test crosses, in conjunction with cytological and embryological studies, are necessary to determine the precise mode of reproduction.

The results are discussed in relation to the difficult taxonomy of *Rubus*.

260. Crane, M. B. 1940. The origin of new forms in *Rubus*. II. The Loganberry, *R. loganobaccus* Bailey. *J. Genet.*, **40**, pp. 129-40.

Although the loganberry arose as recently as 1881, the details of its origin

are in dispute. It has been held (1) that the loganberry is a hybrid, the result of a cross between a blackberry and a raspberry, and (2) that it is not a hybrid but a direct derivative of the wild blackberry or dewberry of California, *Rubus ursinus vitifolius*. The present experiments were planned to decide between the two theories.

From crossing *R. vitifolius* (8*x*) with *R. idaeus* (4*x*) a hybrid was obtained which in morphology, chromosome number, sex, and fertility closely matched the loganberry; like the loganberry it is a hexaploid and nearly true breeding.

Crosses made between *R. vitifolius*, *R. idaeus* 2*x*, and the loganberry, in which *R. vitifolius* and *R. idaeus* chromosomes were brought together in different proportions, gave results which are also in agreement with the hybrid view.

The only conclusion which can be reached from the experiments is that the loganberry is a hybrid as originally supposed, derived from an unreduced male germ cell of a raspberry, which is known to correspond to the diploid type, and a normal reduced germ cell of the blackberry.

The breeding data suggest that in *R. vitifolius* the female is the heterozygous sex.

261. Crane, M. B. 1941. New blackberries. *Gdng Illus.*, **63**, p. 561.

262. Crane, M. B. 1941. Pomology department. *Rep. John Innes hort. Instn for 1940*, pp. 4-6.

An inverse correlation exists between pollen fertility and percentage of developed drupelets among the progeny of species crosses in *Rubus*. High pollen fertility goes with low drupelet development and indicates a predominantly sexual mode of reproduction.

Exceptional development within the embryo sac may lead to fusion of haploid nuclei, presence of two differentiated eggs and one synergid or presence of three undifferentiated nuclei at the micropylar end. These abnormalities account for the segregation of characters among asexual progeny. Embryo-sac development taken with breeding behaviour in six polyploid *Rubus* species shows that the transition from sexual to apomictic reproduction goes with the transition from allo- to auto-polyploidy [cf. Gustafsson, 1942, 1943].

The general method of apomictic reproduction in *Rubus* is apospory, and the proportion of sexual and apomictic ovules for a particular plant is fixed within certain limits before pollination. The variation in the proportion of sexual and non-sexual seedlings that occurs among families where different male parents have been used is almost entirely due to differences in the compatibility of the sexual embryos with the mother plant, and not to competition of sexual and asexual embryos.

263. Crane, M. B., and **Thomas, P. T. 1941.** Reproductive versatility in *Rubus*. *Proc. 7th int. Genet. Congr. Edinb., August 1939*, p. 91.

The diploid species of *Rubus* investigated always reproduce sexually, whilst in polyploid forms reproduction may be (1) entirely sexual, (2) entirely non-sexual, or (3) partly sexual and partly non-sexual (apomictic). *Rubus* species vary widely in the degree to which apomixis is developed, and a particular species will show a variation in behaviour depending on the species used as male in the cross pollination. Segregation occurs in the non-sexual offspring leading to new forms which may be true breeding.

Segregation among non-sexual offspring indicates that the apomictic embryo develops subsequent to the first division of meiosis and evidence has been obtained that fusion of nuclei within a haploid embryo sac can occur. New forms commonly arise through hybridization and chromosome duplication. Such common occurrence of chromosome duplication by the formation of unreduced gametes is probably symptomatic of apomictic behaviour in *Rubus*.

264. Crane, M. B. 1943. Pomology department. *Rep. John Innes hort. Instn for 1942*, pp. 3-6.
Loganberry $6x$ × Hailsham $4x$ gave sexual progeny. All the plants raised were $5x$. Loganberry $6x$ × Youngberry $6x$ also gave sexual progeny, whilst the reciprocal cross failed. This failure did not appear to be due to pollen incompatibility.

265. Crane, M. B. 1944. Pomology department. *Rep. John Innes hort. Instn for 1943*, pp. 3-9.
From studies by P. T. Thomas, it is concluded that the chromosomes of the raspberry and blackberry have become differentiated by genic differences controlling such physiological processes as chromosome pairing, rather than by structural change. The Veitchberry shows failure of pairing, suggesting genic interference, and a poly-haploid derived from the Veitchberry behaves as a typical asynaptic plant with a range from almost complete failure of pairing to complete association.

266. Crane, M. B. 1946. Pomology department. *Rep. John Innes hort. Instn for 1945*, pp. 6-12.
Chromosome behaviour at meiosis in the Youngberry is irregular. There are on an average 2_{iv}, 3_{iii}, $3\text{-}9_{i}$ and the remainder bivalents in this hexaploid ($2n=42$). The Youngberry arose as a hybrid between the allohexaploid Phenomenal berry (which is of similar origin to the loganberry) and the hexaploid Mayes dewberry. Hybrids between Youngberry and loganberry are in effect backcrosses to the loganberry. Many such hybrids proved to be aneuploid and meiosis was irregular even in euploid types. Youngberry and loganberry both proved completely self-compatible. Loganberry ♂ Youngberry is compatible but the reciprocal is completely incompatible, due to slow growth of pollen tubes, the inhibition being greater at higher temperatures, suggesting a positive inhibition rather than a nutrient deficiency effect.

The progeny of Youngberry selfed and from the Youngberry × loganberry F_1 and F_2 showed a wide range of male and female sterility. The progeny from Youngberry selfed segregated into plants which were compatible and plants which were incompatible with loganberry pollen.

267. Crane, M. B. 1947. Growing raspberries from seed. *Grower*, **27**, pp. 710, 717.
It is suggested that intercrossing inbred lines will give the best results. It is noted that Lloyd George selfed throws about 25% of yellow fruited seedlings and that Superlative and Norwich Wonder give 25% of male plants.

268. Crane, M. B. 1948. Pomology department. *Rep. John Innes hort. Instn for 1947*, pp. 4-10.
Mixed plantations of tt (green spines, yellow fruit) and TT raspberry

clones were grown in isolation. Seed collected from tt plants in a single row of alternate TT and tt plants gave 103 red and 4 green (96·3% outcrossing). From two rows of alternate TT and tt individuals in which the opposite plants in the two rows were of different colour, the entire progeny from the tt plants were red; there was no self pollination at all. It is suggested that TT pollen grows down the style more rapidly than tt pollen.

269. Crane, M. B., and **Thomas, P. T. 1949.** Reproductive versatility in *Rubus*. III. Raspberry-blackberry hybrids. (With appendix on an integrated species difference, by **C. D. Darlington**.) *Heredity*, **3,** pp. 99-107.

The Veitchberry $4x=28$, from *R. rusticanus* $2x=14$ and a tetraploid form of *R. idaeus* $4x=28$, breeds true to its intermediate character on selfing.

In crosses with *R. idaeus* the Veitchberry behaves as a species, but exceptional diploid forms have appeared in the progeny: four blackberry-like, two intermediate but slender, and one raspberry-like.

Blackberry and raspberry chromosomes normally pair among themselves when two sets of each are present in a hybrid. With less opportunity for differential pairing as in the Mahdiberry ($3x=21$), chromosomes of the two types can pair effectively with one another.

The allotetraploid Veitchberry shows considerable failure of pairing, this appears to be due to genotypic control, since no structural differences were observed between the raspberry and the blackberry chromosomes. One of the intermediate diploid plants from the Veitchberry similarly behaved like an asynaptic diploid.

It is concluded that seven diploids in the progeny from Veitchberry ($4x=28$) × raspberry ($2x=14$) originated parthenogenetically from the embryo sacs of the Veitchberry.

Darlington suggests that the characters 'permanent brambles of unlimited growth, few broad thorns, palmate leaves, black fruits and fixed plug' in the blackberry and 'short-lived canes of limited growth, many narrow prickles, pinnate leaves, red fruits and free plug' in the raspberry behave as a supergene, the characters being recombinable within each group but held together in crosses between groups. Such a system may have arisen by inversion of a segment of chromosome.

270. Crane, M. B. 1950. Pomology department. *Rep. John Innes hort. Instn for 1949*, pp. 6-9.

Covers much the same field as the preceding paper.

271. Crane, M. B., and **Lawrence, W. J. C. 1952.** The genetics of garden plants. Macmillan & Co., London, 4th edn, 301 pp.

272. Crane, M. B. 1953. Pomology department. *Rep. John Innes hort. Instn for 1952*, pp. 6-10.

Bedford Giant ($6x$) and loganberry ($6x$) are self-fertile; Veitchberry ($4x$) and Merton berry ($5x$) proved self-sterile but both set well when pollinated with Hailsham berry.

Work reported in greater detail by Haskell (1953) is also discussed.

273. Crane, M. B. 1953. The genetics and breeding of fruit trees. *Rep. 13th int. hort. Congr.*, London, pp. 687-95.

The results of spraying selfed families of gooseberries with a sulphur wash for the control of gooseberry mildew were as follows:

	Non-leaf-droppers	*Leaf-droppers*
Whinham's Industry	98	0
May Duke	92	0
Early Green Hairy	56	14
Pitmaston Greengage	95	36
Ostrich	115	60
Langley Gage	80	42
Golden Drop	23	2

274. Crang, A., Kendall, L., and **Sturdy, M. 1950.** A comparison of some varieties of fruit preserved by bottling, canning and freezing. I. *Rep. Long Ashton Res. Sta.*, pp. 197-207.

Himalayan Giant blackberry gave a slightly higher average score than Merton Early and Ashton Cross.

Cotswold Cross black currant gave the highest average score for bottling and canning considered together, and Mendip Cross was the poorest, but the difference was small. Malvern Cross was best for freezing and Baldwin worst.

Whinham's Industry gooseberry came bottom of all processing trials averaged, but the difference between this and Keepsake and Leveller, the other varieties under test, was not great.

Promise, Norfolk Giant, and Seedling W raspberries all averaged within one mark of each other for canning, freezing and bottling combined.

275. Crang, A., and **Sturdy, M. 1951.** A comparison of some varieties of fruit preserved by bottling, canning and freezing. Progress report. II. *Rep. Long Ashton Res. Sta.*, pp. 193-9.

Average scores (out of 40) for bottling, canning and freezing combined were: Black currants: Baldwin 29·8, Cotswold Cross 31·6, Malvern Cross 31·0, Mendip Cross 30·4, Seabrook 31·7, and Westwick Choice 31·1.

Gooseberries: Keepsake 30·3, Leveller 32·1, Whinham's Industry 29·1.

276. Crang, A., and **Sturdy, M. 1952.** A comparison of some varieties of fruit preserved by bottling and by freezing. III. *Rep. Long Ashton Res. Sta.*, pp. 177-85.

Bottling and canning results having been found to be similar, canning was omitted from the trials. Blackberry results (out of 10) were: Ashton Cross 7·2, Himalayan Giant 7·3, Merton Early 6·7.

Gooseberries: Keepsake 6·9, Leveller 7·5 and Whinham's Industry 7·1.

277. Crang, A., and **Sturdy, M. 1953.** A comparison of some varieties of fruit preserved by bottling and by freezing. IV. *Rep. Long Ashton Res. Sta.*, pp. 199-205.

The following marks (out of 30) were scored for named raspberry varieties:

	Fresh	*Bottled*	*Frozen*
Landmark	19·8	15·2	17·9
Lloyd George	22·3	21·5	22·4
Enterprise	23·3	18·6	23·0
Exploit	18·0	15·9	20·2
Jewel	21·8	18·0	21·2
Promise	19·0	19·4	19·8
Newburgh	20·3	16·2	17·9
Norfolk Giant	22·1	20·6	24·4

278. Crang, A., and Sturdy, M. 1954. A comparison of some varieties of fruit preserved by bottling and by freezing. V. *Rep. Long Ashton Res. Sta.*, pp. 192-8.

The following marks (out of 30) were scored for named raspberry varieties:

	Fresh	*Bottled*	*Frozen*
Early Red	21·2	—	21·1
Landmark	20·3	—	19·6
Lloyd George	20·2	20·1	21·6
Enterprise	23·9	21·7	23·5
Exploit	20·6	20·8	18·1
Jewel	22·8	20·2	22·4
Promise	19·9	20·2	19·6
Milton	23·5	20·7	22·0
Preussen	19·5	17·5	18·7
Royal Scot	21·4	21·4	21·8
St. Walfried	20·1	21·4	21·8

279. Crang, A., and Sturdy, M. 1955. A comparison of some varieties of fruit preserved by bottling and by freezing: Progress report. VI. *Rep. Long Ashton Res. Sta.*, pp. 182-7.

Early Red was one of the most satisfactory raspberry varieties both fresh and preserved, combining good appearance and flavour. Lloyd George was rather too dark when fresh (an advantage when preserved), but its flavour was one of the best. Enterprise had a good appearance and fairly good flavour when fresh, but was not outstanding when preserved. Exploit was too pale when bottled and its flavour throughout was weak, but it retained its shape well in processing. Jewel had a very good appearance and fair flavour when fresh, but colour and texture were not so good in the preserved material. Landmark was too pale and crumbly, though the flavour was fairly good. Promise had a good appearance throughout and a fair to good flavour. Milton was disappointing when fresh or bottled but was rather better when frozen. Newburgh was below average flavour whether fresh or frozen, but cold-stored bottled fruit was of good colour and flavour. Preussen, the poorest for flavour, was only of moderate appearance.

280. Crozier, A. A. 1894. The cultivated raspberries of the United States. *Bull. Mich. agric. Exp. Sta.*, **111.** (Condensed from *Exp. Sta. Rec.*, **6**, pp. 299-300.)

An annotated catalogue giving the botanical origin, history, and qualities of varieties grown in America. Of 433 names given, 83 are synonyms. The following varieties are recommended for Michigan and adjacent regions: Black-caps—Gregg, Nemaha, Palmer, Ohio, Hilborn, Kansas and Conrath; purple caps—Shaffer and Columbia; reds—Cuthbert, London, Turner, Thwack, Marlboro, and Hansell.

281. Crüger, —. 1933. (The premature dying-off of currant leaves.) *Kranke Pflanze*, **10** (7-8), pp. 106-7.

Leaf-spot of currants (*Pseudopeziza ribis*) causes heavy damage in the Königsberg district of Prussia; Red and White Versailles and Fay's Prolific are susceptible. Marked resistance is shown by Red Dutch and Earliest of Fourlands.

Culver, L. B. 1939. *See* **Darlington, H. T., and Culver, L. B.**

282. Culverwell, W. 1892. Hybrid between black currant and gooseberry. *Gdnrs' Chron.*, **12,** Ser. 3, pp. 161, 271, 277, 346.

283. Cunningham, G. H. 1922. A fungus disease attacking blackberry. *N.Z. J. Agric.*, **24,** pp. 23-6.

Cane wilt, *Leptosphaeria coniothyrium*, the most serious disease of raspberries in New Zealand, has begun to attack blackberries in parts of North Island.

On the blackberry (*Rubus fruticosus*) the infection is relatively mild, occurring chiefly on the panicles. Varietal differences in susceptibility occur in the blackberry.

284. Curl, A. L., and **Nelson, E. K. 1943.** The occurrence of citric and isocitric acid in blackberries and in dewberry hybrids. *J. agric. Res.*, **67,** pp. 301-3. (Condensed from *Exp. Sta. Rec.*, **90,** p. 149.)

The non-volatile acids present in three blackberries, Brainerd, Crandall, and Texas Wonder, and in two trailing hybrids, Boysen and Young, were investigated by the ester distillation method. Isocitric acid predominates in Brainerd, Crandall, and Texas Wonder, all of which are eastern blackberries. Citric acid is the principal acid of Boysen and Young dewberries and loganberry, all of which are related to the Pacific coast blackberry.

285. Darlington, C. D. 1925. *Ribes. Rep. John Innes hort. Instn for 1924*, p. 34.

The somatic number of chromosomes in *Ribes oxyacanthoides* and *R. grossularia* is 2n=16.

286. Darlington, C. D. 1927. Reversion in black currants: A study of the chromosome complement. *J. Pomol.*, **6,** p. 242.

The somatic metaphase chromosomes of a reverted and of a healthy black currant appeared to be identical. This complement was comparable in number and form with that of *Ribes grossularia* and *R. oxyacanthoides*, both 2n=16, and two chromosomes with satellites were seen.

Darlington, C. D. 1927. *See* **Crane, M. B.,** and **Darlington, C. D.**

287. Darlington, C. D. 1929. A comparative study of the chromosome complement in *Ribes*. *Genetica*, **11,** pp. 267-9.

Ribes aureum, *R. sanguineum*, and their hybrid *R. gordonianum*, have almost indistinguishable complements, the shortest chromosome being about 1·5 μ and the longest about 2·5 μ in each. Apparent size differences between the complements of *R. aureum* and *R. sanguineum* found by Tischler (1906-1927) were probably due to bad fixation. Hence the observation of large and small bivalents at meiosis by Tischler does not indicate autosyndesis in the hybrid.

Ribes, *Rubus* and *Prunus* show a striking constancy of chromosome form and regularity of chromosome number. 'Evidently in these genera fragmentation, translocation, and like phenomena can be of little phylogenetic consequence for they would at once destroy the constancy of the chromosomes and reduce the regularity of their behaviour at meiosis.'

Darlington, C. D. 1932. *See* **Crane, M. B.,** and **Darlington, C. D.**

288. Darlington, H. T., and **Culver, L. B. 1939.** Keys to the species of *Ribes* occurring in the Great Lakes region. *Circ. Mich. agric. Exp. Sta.*, **170,** 24 pp. (From *Exp. Sta. Rec.*, **82,** p. 68.)
A winter key based on stem and twig characters, a summer key based on leaves, flowers and fruits, and descriptions of 14 species are included. Extensive investigations are said to have shown that all *Ribes* species in this region are susceptible to the white pine blister rust (*Cronartium ribicola*), though with marked differences in degree.

289. Darrow, G. M. 1920. Are our raspberries derived from American or European species? *J. Hered.*, **11,** pp. 179-84.
The following are classed as pure *Rubus strigosus*: Crystal White, Miller, Ohta, Perfection, Rancocas, Royal Church, Scarlet Gem, Superb, Thwack, and Turner.
Varieties of *R. strigosus* which may have a trace of *R. occidentalis* blood: Early Prolific, Eaton (Idaho), King, Minnesota 4, Minnetonka, Ranere (St. Regis), Sunbeam.
Varieties of *R. idaeus*: Antwerp, Buckeye, Eastern King, Fillbasket, Franconia, Hiram, Ohio Everbearing, Perfection of Wisconsin, Red Merville, La France (Cobb), Segrist, Sonchetti, Superlative, Surprise, Syracuse, Wisbeck Perfection.
Varieties of *R. idaeus* × *R. strigosus*: Crimson Beauty, Cuthbert, Empire, Erskine [Park], Golden Queen, Hansell, Herbert, June, Marlboro.
Varieties of *R. idaeus* · *R. occidentalis*: Abundance, Royal, and Schaffer.

290. Darrow, G. M. 1924. The Van Fleet raspberry; a new hybrid variety. *Circ. U.S. Dep. Agric.*, **320,** 14 pp.
The Van Fleet raspberry, a hybrid between *Rubus innominatus* and Cuthbert, shows marked resistance to leaf spot (*Septoria rubi*), anthracnose (*Gloeosporium* [*Elsinoë*] *venetum*), leaf rust (*Pucciniastrum americanum*), crown gall (*Bacterium tumefaciens*), and cane blight (*Coniothyrium fuckelii*=*Leptosphaeria coniothyrium*). One definite case of mosaic disease has been seen in it and another suspected. The variety has a late ripening season and a high yield.

Darrow, G. M. 1924. *See* **Longley, A. E.,** and **Darrow, G. M.**

291. Darrow, G. M. 1926. Raspberry breeding experiments, hybrids and backcrosses between red and black varieties. *J. Hered.*, **17,** pp. 338-48.
In crossing black with red raspberries, the use of the latter as female has invariably resulted in failure. Hybrids between Winfield black raspberry and Golden Queen, an albino red variety, bore purple fruit. Plants of Winfield × Golden Queen, Winfield · Cuthbert, and Winfield · Marlboro composition were mostly sterile; Winfield × Ontario gave much more fertile seedlings, while Winfield × Newman and Farmer · Latham gave a high percentage of fertile seedlings. Backcrosses of the hybrid Royal to Newman and to Latham gave a high percentage of desirable red-fruited selections which often showed greater firmness than either parent. The backcrosses covered a wider range in season of ripening than either parent.

292. Darrow, G. M. 1927. Progress in fruit breeding. *J. Hered.*, **18,** pp. 288-304.
A popular account covering the work of Experiment Stations and of the U.S. Department of Agriculture.

293. Darrow, G. M. 1928. Notes on thornless blackberries. Their chromosome number and their breeding. *J. Hered.*, **19**, pp. 138-42.
The Cory Thornless blackberry, a bud sport from Mammoth, is a chimaera, which, like the Mammoth, is adapted only to the Pacific Coast regions. It is self-sterile. Austin Thornless (n=28) is not a chimaera, consequently it comes true from root cuttings. Burbank Thornless, a seedling of a thornless European garden form, is self-sterile. Hybrids between Burbank Thornless (n=7) and Oregon Evergreen (n=14) all proved sterile, whereas hybrids between Himalaya (n=14) and Oregon Evergreen were quite fertile. *Rubus canadensis* (2n=21), a shade-loving, cool climate species from eastern N. America, is thornless and of good flavour. Thornless sports of Himalaya and Oregon Evergreen are recorded.

294. Darrow, G. M. 1930. Effect of light, temperature, and transpiration on elongation of canes of raspberry and other brambles. *Proc. Amer. Soc. hort. Sci.*, **26**, pp. 308-11.

295. Darrow, G. M. 1931. Varieties of berries. *Proc. Wash. St. hort. Ass.*, **27**, pp. 183-4.

296, Darrow, G. M. 1931. A productive thornless sport of the Evergreen blackberry. *J. Hered.*, **22**, pp. 405-6.
Previous thornless sports of the Evergreen have been weak and partially sterile: the sport described here has lost no vigour nor hardiness and its fruits are of the parental type. The plant is a chimaera and no thornless plants have appeared among its seedlings.

297. Darrow, G. M. 1931. European blackberry seedlings and hybrids in the Pacific Northwest. *J. Hered.*, **22**, pp. 143-6.
Two varieties of European blackberry (Evergreen and Himalaya) have been planted extensively in the Pacific Northwest. Evergreen (syn. Cut Leaved, American Cut-leaf, Parsley Leaved) was probably introduced prior to 1860. Himalaya was introduced by Burbank about 1889. Both varieties, but especially Evergreen, heavily outyield varieties of American origin. Evergreen × Himalaya gave only two true crosses and both had small fruit; the remaining plants were identical with Evergreen and probably apomicts, as were several hundred selfed seedlings of this variety.

In general, Evergreen seedlings in the wild were all identical. The few variants found differed chiefly in the degree of laciniation and bred true from seed. In season of ripening, and in size and flavour of fruit, no differences were observed which could not be caused by environmental variation.

Wild plants of Himalaya showed more variability than those of Evergreen, especially in time of ripening, flavour, size and firmness of fruit. Parallel variations appeared at widely separated localities. Selfed seedlings raised at Glenn Dale, Maryland, were all identical with the Himalaya and appeared to be apomictic.

298. Darrow, G. M., and Sherwood, H. 1932. Seed and berry size of cane fruits. *Proc. Amer. Soc. hort. Sci.*, **28**, pp. 194-9.
The weights per seed given by Peitersen (1921) are corrected to read as follows: 1·596 mg. *Rubus allegheniensis*, 1·640 *R. argutus*, 1·912 *R.*

frondosus, and 3·860 *R. baileyanus*. Peitersen's table gave the weights ten times too large. In this group the erect growing species have the smaller seeds.

The average weight (mg.) of a single seed ranges from 1·08 in *R. leucodermis*, 1·43 in Cuthbert and Lloyd George, 1·95 Farmer, 2·30-2·55 for the group Mammoth, Lucretia, Stuart, Logan, 2·62 Brainerd, 2·89 Nanticoke, 3·09 Himalaya, 3·70 Evergreen to 3·82 Young. Individual seedlings of Logan ranged from 1·80 to 2·99. The average number of drupelets per berry was highest in *R. leucodermis* with 103·5, Lloyd George, Mammoth and three out of 24 Logan seedlings had more than 90 drupelets; Ideal Wild, Nanticoke, Himalaya, and Evergreen all had less than 50.

299. Darrow, G. M., and **Waldo, G. F. 1932.** The Glenndale gooseberry. *Circ. U.S. Dep. Agric.*, **223,** 4 pp.

The Glenndale gooseberry is described, it is adapted to the southern limits of gooseberry culture.

300. Darrow, G. M., and **Waldo, G. F. 1932.** Berry breeders seek new varieties adapted to specific purposes. *Yearb. U.S. Dep. Agric.*, pp. 113-14.

301. Darrow, G. M., and **Waldo, G. F. 1932.** The Brainerd blackberry. *Circ. U.S. Dep. Agric.*, **220,** 4 pp.

Brainerd, from Himalaya crossed with an erect variety from eastern U.S.A. (possibly Georgia Mammoth), is vigorous, productive, and hardy, but thorny and susceptible to orange rust and double blossom. It is superior to Himalaya in canning, preserving, and freezing. It propagates fairly freely by tip layering and very freely by root cuttings.

302. Darrow, G. M., and **Longley, A. E. 1933.** Cytology and breeding of *Rubus macropetalus*, the logan, and related blackberries. *J. agric. Res.*, **47,** pp. 315-30.

The highest dessert quality in dewberries and blackberries occurs in a group derived from *R. macropetalus* Dougl. and related species of wild trailing blackberries that occur in the western parts of California, Oregon, Washington, and British Columbia. Western trailing blackberries differ from eastern species in being chiefly dioecious, and in having leaflets usually pinnate, shoots and canes more or less glaucous, and smaller drupelets and seeds. Western forms have 42, 35, 28 or 21 chromosomes whereas most eastern forms have 21.

Descriptions are given of *R. macropetalus*, *R. ursinus* Cham. & Schlecht. and *R. loganobaccus* Bailey. The first is by far the most abundant, being the only species throughout western British Columbia, Washington, and Oregon. Its southern range extends into the highlands of California. *R. ursinus* and *R. loganobaccus* are confined chiefly to a coastal belt in northern and central California. Thornless plants of *R. macropetalus* are recorded, and a new variety of *R. ursinus* (var. *monophyllus*) is described.

Logan (n=21)×Mammoth (n=21) gave 162 plants almost or entirely sterile and two plants partially sterile. Out of 8 examined, 6 plants had 21 chromosomes and 2 had 35/2 chromosomes. Logan×Young (n=21) gave 148 almost or entirely sterile plants and 21 partially fertile. Of 10 plants examined, 9 had 21 chromosomes and one had 21/2 chromosomes.

Logan × Lucretia (n=21) gave 18 nearly or quite sterile plants and one partially fertile, these had 21 chromosomes. Plants believed to be hybrids of *R. macropetalus* (n=42) × logan gave some perfect flowered fertile seedlings.

The following chromosome numbers were observed: *R. macropetalus* n=42; wild *R. loganobaccus* n=21; plants taxonomically similar to *R. loganobaccus* 28, 35; Himalaya n=14; *R. spectabilis* (Salmonberry) n=7; *R. parviflorus* (Thimbleberry) n=7; *R. leucodermis* (Western Black Raspberry) n=7; Lloyd George and Cuthbert raspberries n=7; Burbank Thornless n=7; Evergreen n=14; Brainerd (=Himalaya × eastern blackberry) 21/2; Austin Thornless dewberry n=28.

The loganberry (n=21), supposedly from a cross between Aughinbaugh blackberry and Red Antwerp raspberry, is considered more likely a sport of *R. loganobaccus* [cf. Darrow, 1955a]. In contrast to Crane and Darlington's results, several hundred seedlings showed variation comparable with that within a true species, and nearly all of 400 seedlings were productive and not defective. Out of 409 seedlings, 269 had glaucous and 140 had glabrous canes, approximating to a 2:1 ratio. Of 11 logan seedlings examined, 10 were hexaploid (2n=42) and one was pentaploid (2n=35). This latter showed more irregularities in division than the hexaploids and had 50% of aborted pollen.

The excellent quality and fertility of *R. macropetalus* × logan hybrids indicates the possibility of using all three species of western trailing hybrids for breeding.

303. Darrow, G. M., and **Waldo, G. F. 1933.** Pseudogamy in blackberry crosses. *J. Hered.*, **24,** pp. 313-15.

European blackberries are normally pseudogamous; American blackberries are not, except possibly for *Rubus canadensis* [cf. Einset, 1951]. Schuster showed Evergreen (*R. laciniatus*) to be completely pseudogamous. The present writer raised several hundred seedlings of Oregon Evergreen, Himalaya (*R. procerus*) and Edward Langley and all were pseudogamic. Flowers of Oregon Evergreen pollinated with Himalaya yielded two hybrids out of about ten seedlings. In crosses of Oregon Evergreen and of Himalaya with pollen of various American varieties it was found that about one-tenth of the former and a third of the latter may be expected to be hybrid seedlings and the remainder pseudogamic. Himalaya × Eureka (*R. cuneifolius*) gave 8 out of 10 true hybrids.

304. Darrow, G. M., and **Waldo, G. F. 1933.** The Potomac raspberry. *Circ. U.S. Dep. Agric.*, **259,** 4 pp.

Potomac, from Farmer (black) × Newman red raspberry, is more vigorous and productive, better suited to canning and preserving, has a longer ripening season and is more resistant to virus diseases than black raspberries, with which it is most nearly comparable. It is hardy and resistant to leaf spot and anthracnose.

305. Darrow, G. M., and **Waldo, G. F. 1934.** Raspberry and blackberry cane measurements. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 269-74.

Measurements made on canes of high and low yielding fields of Cuthbert in Washington showed that higher producing fields have taller canes, greater basal diameter and fewer buds per cane on the part left after pruning.

Records on 25 canes of each of 6 varieties in Oregon showed that there were more buds and fruiting laterals on the basal 4 ft of the weaker canes than on the more vigorous ones. The percentage of buds which develop was about the same for strong as for weak canes, but the number of berries per fruiting lateral was much greater for the strong canes.

Inter-varietal comparisons of buds per foot for the lower part of the cane showed that 2-year-old Lloyd George and Latham had the most, and Ranere the fewest.

In blackberries and dewberries (mature plants) the number of buds per cane and per foot of cane was much greater in Logan and Young than in Himalaya, Evergreen and Thornless Evergreen, while the latter group had fewer and larger canes than the Logan and Young.

Most of the growth in diameter of Farmer (black raspberry) and Evergreen canes took place early in the season, and of the Logan late in the season. Increase in length of cane was greatest for Farmer in the early part of the season, but for Evergreen and Logan during the latter part.

306. Darrow, G. M. 1935. Susceptibility of raspberry species and varieties to leaf spot (*Mycosphaerella rubi*) at Beltsville, Maryland. *Phytopathology*, **25,** pp. 961-2.

Many varieties, including Viking, Lloyd George and Newburgh, are too susceptible to leaf spot to yield anything as far south as Maryland. These were not included in the types examined. In 1934 Latham and Chief lost more than half their leaves and the variety June was nearly defoliated by mid September. No species from Asia has proved susceptible, and most Asiatic species are also either immune or highly resistant to anthracnose and spur blight. Hardiness of American varieties depends largely on resistance to leaf spot because early defoliation prevents adequate accumulation of food reserves.

The following groups of varieties and species are tabulated:

(1) More resistant than Latham: *Rubus biflorus*, *incisus*, *innominatus*, *inopertus*, *kuntzeanus*, *mesogaeus*, *parvifolius*, *niveus*, *phoenicolasius*, *rosaefolius*, *veitchii*, F.P.I. 69115, Van Fleet, Arkansas-red, F.P.I. 75145-red; USDA 0, 8, 9, 11-red; NY2609-black; NY5555, 5621, 5670-red; NY10723-purple; NY10724; NY14619-red.

(2) As resistant as Latham and Chief: (*a*) Black varieties: Bristol, Dundee, Golden King, Naples, Potomac (purple); (*b*) Red varieties: USDA 5, 7; NY5371, 6523, 8126 and 14443.

(3) Highly susceptible: (*a*) Black varieties: Black Beauty, Black Giant, Cumberland, Kansas, Farmer, Honey Sweet, Madison, New Logan, Perfection, Quillen, and Royal (purple). (*b*) Red varieties: June and White Queen.

307. Darrow, G. M. 1935. Promising new berries and their breeding. *Trans. Peninsula hort. Soc.*, **25** (5), pp. 13-15.

A popular account which includes notes on a number of varieties. The Youngberry is not fully hardy; Thornless Young is said to be somewhat hardier. Newburgh and Viking are particularly subject to leaf spot and anthracnose. Taylor, which has a long thimble-shaped berry, is relatively resistant to diseases. The Potomac purple is one of the hardiest raspberries in the country, and it is less susceptible to anthracnose than black raspberries.

308. Darrow, G. M. 1936. The Boysen dewberry (Boysenberry). *Circ. U.S. Dep. Agric., Bur. Plant Ind.*, p. 1.

309. Darrow, G. M. 1937. Berry breeding. *J. Wash. Acad. Sci.*, **27**, p. 42 (Abstr.).

In red raspberry crosses hardiness was found to be dominant. Other matters discussed included the inheritance of resistance to streak virus, hybridization with Asiatic raspberries, crosses of Logan with its wild relatives, and the inheritance of thorniness, but no data on these are included in the abstract.

310. Darrow, G. M. 1937. Blackberry and raspberry improvement. *Yearb. U.S. Dep. Agric.*, pp. 496-533.

Blackberries.—The wild blackberries of North America fall into five major groups: (1) The erect or nearly erect types like Early Harvest and Eldorado, of the eastern U.S. from Florida to Canada and from the Atlantic coast to the prairie states; (2) the eastern trailing blackberries, not red-hairy caned, much like the Lucretia, having about the same range as the erect ones; (3) the south-eastern trailing blackberries having red hairs on the canes, like the Manatee and Advance, ranging along the Atlantic and Gulf coasts from Delaware to Texas; (4) the trailing blackberries, from which Logan is derived, of the Pacific coast from Canada to California; and (5) the semi-trailing Evergreen (Black Diamond [cf. Abstr. 129]) and Himalaya of Oregon, Washington, and California, naturalized from Europe.

Normally the wild blackberries from the east are entirely or nearly self-sterile, and those of the Pacific coast are dioecious so that out-breeding is the rule. The clearance of forest land has increased the spread and inter-crossing of the various species and it is doubtful how many species should be recognized.

Brief descriptions are given of *Rubus allegheniensis* Porter, *R. argutus* Link., *R. pergratus* Blanch., *R. frondosus* Bigel., *R. canadensis* L., *R. vermontanus* Blanch., *R. cuneifolius* Pursh., *R. baileyanus* Britt., *R. trivialis* Michx., *R. ursinus* Cham. & Schlecht., *R. macropetalus* Dougl., and *R. loganobaccus* Bailey.

The probable derivations of cultivated varieties are:

R. allegheniensis × *R. argutus:* Ancient Briton, Eldorado, Taylor.

R. allegheniensis × *R. frondosus:* Agawam, Erskine Park, Jumbo, Lawton, Snyder, Stone, Wachusett.

R. argutus × *R. frondosus:* Blowers, Erie, Mersereau.

R. baileyanus × *R. enslenii:* Premo.

R. baileyanus × *R. argutus:* Mayes, Lucretia.

R. argutus: Early Harvest.

R. frondosus or (*R. frondosus* × *R. argutus*) × *R. frondosus:* Joy, La Grange, Ward, Watt.

R. cuneifolius: Eureka, Nanticoke (possibly *cuneifolius* × *argutus*).

R. trivialis: Manatee, Rogers, Advance.

R. loganobaccus: Logan.

R. loganobaccus × (*R. baileyanus* × *R. argutus*). Young, Boysen.

There are two main centres of wild blackberries: eastern N. America and Europe. According to Focke (1910-14) the European and American species were separated in comparatively recent times—probably in the Ice Age.

The work and achievements of Experiment Stations and others in breeding blackberries are surveyed.

Raspberries.—According to Hedrick (1925) the first red raspberries were introduced into cultivation in Europe about 400 years ago. In America Cuthbert arose as a chance-seedling in 1865. It was probably a cross of Hudson River Antwerp (a European variety) with a wild native red.

R. idaeus is native in much of Europe and closely allied forms occur across northern Asia to Japan. The American raspberry *R. strigosus* is native in the mountains from Georgia to Pennsylvania and in both lowlands and mountains from Maine to the Dakotas, far north in Canada and west to British Columbia. It has much greater hardiness than the European species, the canes are more slender and often more erect and the prickles are reduced. The berries are seldom thimble-shaped and are usually bright red. The species is extremely variable in the wild.

R. occidentalis, the American black raspberry, is sympatric with *R. strigosus* but extends farther south and is less common at the northern end of the range. It is not as hardy as *strigosus*. A closely allied species, *R. leucodermis*, occurs from British Columbia to California.

Yellow or amber fruited black raspberries are common, and yellow and amber colours are common in European raspberries but are rare in American wild red raspberries.

Three other raspberries are grown in some parts of the world: the Andes black raspberry (*R. glaucus* Benth.) in northern S. America, *R. niveus* Thunb. (*R. lasiocarpus* Sm.) in northern India and Burma, and the wineberry *R. phoenicolasius* Maxim. introduced in the north-eastern U.S. from Japan. *Rubus ellipticus* Sm., the Golden Evergreen raspberry, may have canes 3 in. in diameter and grow 14 ft high.

Eastern Asia is the centre of the wild raspberries of the world.

Wild species of possible value include: For size of fruit, Akala and *R. biflorus*; for vigour *R. ellipticus* and *R. biflorus*; for disease resistance *R. biflorus*, *R. ellipticus*, *R. coreanus* Miq., *R. glaucus*, *R. kuntzeanus*, *R. innominatus* Moore.

The work and achievements of raspberry breeders in America and elsewhere are surveyed.

Sources of superior qualities in blackberries

Hardy against cold.—*R. pergratus*, *R. canadensis*, *R. alleghaniensis*, Snyder, Eldorado, Ancient Briton, Agawam.

Resistant to orange rust.—Eldorado, Oregon, Evergreen, Russell, Snyder.

Resistant to double blossom.—Himalaya, Rogers, Advance (? syn. Rogers).

Resistant to root nematode.—Hall Lawton, Young, Crandall.

Resistant to crown gall.—Austin Thornless, Advance.

Resistant to Septoria.—Young, Himalaya, Evergreen, Boysen, Early Harvest.

Resistant to anthracnose.—Young, Boysen.

Resistant to Verticillium.—Himalaya and Evergreen, immune; Logan and Mammoth, resistant.

Thornless.—Austin Thornless, *R. canadensis*, Burbank Thornless, Cameron.

Resistant to drought.—Nessberry.

Large flower clusters.—*R. thyrsiger*, *R. nitidioides*, Himalaya, Evergreen.

Early ripening.—Advance and Rogers (earliest), McDonald, Haupt, Lucretia, Young, Mayes, Early Harvest, Wilson Early, *R. borreri.*

Late ripening.—Burbank Thornless, Himalaya, Evergreen, Brainerd, *R. cuneifolius*, Nanticoke, Eureka, *R. rusticanus.*

Firmness.—Oregon (Logan × Young), Advance, Evergreen, Mersereau.
Large fruit.—Boysen, Young, Mammoth, Logan, Eldorado, Brewer.
Canning.—Evergreen, Brainerd, Young, Boysen, Logan, Ideal Wild.
Freezing.—Young, Boysen, Cameron, Logan.
Excellent flavour.—Ideal Wild, Zeilinski, Young, Boysen, Logan, *R. macropetalus*, Cameron, Eldorado, Brewer, *R. allegheniensis*, *R. pergratus*.
Small seed.—Early Harvest.
Lack of seediness.—Young, Boysen.

Sources of superior qualities in raspberries

Hardiness.—Ohta, Latham, Chief, Potomac, Sarah, Starlight, Sunbeam, Newman, Adams 87, Newburgh, King, London, NY3024 (June × Brighton), P117 (Latham × Farmer F_2), Heath, Tekhas.
Resistant to heat.—Van Fleet, Dixie, Ranere.
Resistant to drought.—Sodus, Latham, Marcy.
Resistant to leaf spot.—Van Fleet, Ranere, USDA 9 (Latham × Ranere), Dixie, Potomac, Evans, Pyne's Royal, Bath's Perfection, *R. biflorus*, *R. innominatus*, *R. inopertus*, *R. kuntzeanus*, *R. parvifolius*, *R. phoenicolasius*.
Resistant to anthracnose.—Van Fleet, *R. coreanus*, *R. kuntzeanus*, *R. biflorus*, *R. innominatus*, *R. niveus*, North Carolina R-14, Quillen, Naples, Potomac, Ranere.
Resistant to Phragmidium rubi-idaei.—*R. occidentalis* and *R. leucodermis*, immune; highly resistant reds are Lloyd George, Owasco, Seneca, Antwerp, Ranere (not in California), Cayuga, Herbert, Chief.
Resistant to late raspberry rust.—Hailsham, all black raspberries.
Resistant to spur blight.—Columbian, Newman, Marcy all show some resistance; probably all black varieties are resistant.
Resistant to streak.—Potomac and all red varieties.
Immune to leaf curl.—All purples, Farmer, New Logan.
Resistant to green mottle mosaic.—Latham, Chief, Ranere.
Escaping green mottle mosaic.—Lloyd George, Herbert, Newman, Marcy, Indian Summer, Ranere, Potomac.
Resistant to mosaic in England.—MacLaren, Baumforth A, Red Antwerp B.
Resistant to crown gall.—Surprise.
Resistant to Verticillium.—Syracuse, Cuthbert, Ohta, Antwerp, Marlboro, Cayuga, Owasco, Seneca, Superlative, Black Antwerp A, *R. biflorus*.
Resistant to Amphorophora rubi.—Lloyd George, Herbert, Newburgh, Newman.
Everbearing.—Ranere, La France, Erskine Park, Lloyd George, Indian Summer, Hailsham, November Abundance.
Early ripening.—USDA 0 (Latham × Ranere), Ranere, June, Chief, Ohta, Marlboro, NY3024, Red Cross, Shuttleworth, Kansas, Bristol, Evans.
Late ripening.—Van Fleet, Latham, Newman, Taylor, Cuthbert, NY3041, Rachel.
Firmness.—Potomac, Newman, USDA9 (Latham × Ranere), Newburgh, Latham, Ranere (in California), Baumforth B, Burnetholm, Penwill's Champion, Pyne's Royal.
Large size.—Imperial, Pyne's Royal, Lloyd George, Preussen, Marcy, Newburgh, Taylor, Latham, Sodus, Bristol, Dundee, Cumberland.
Preserving.—Cuthbert, Potomac, Columbian, Lloyd George.

Canning.—Washington 89 (Cuthbert × Lloyd George), Cuthbert, Potomac, Royal, Sodus.

Freezing.—Latham, Chief, Viking, Washington 16, Lloyd George, Cuthbert, Newburgh.

Small seed.—Van Fleet, Lloyd George.

Excellent flavour.—Cuthbert, Viking, Cayuga, Chief, Taylor, Bristol, Evans, Honeysweet, Cumberland, Norwich Wonder A, Preussen, Baumforth B, Hornet A, Pyne's Royal, Park Lane.

Somatic chromosomes in Rubus

2n=14

(*a*) *Blackberries.*—*R. rusticanus* E. Merc., *R. rusticanus inermis* Willd., *R. tomentosus* Borkh., *R. ulmifolius* Schott., Burbank Thornless, *R. allegheniensis* Porter, *R. argutus* Link., *R. canadensis* L., *R. setosus* Bigel, Ancient Briton, Crystal White, Eureka, Haupt, Jordan, Maxwell, McDonald, Pink.

(*b*) *Raspberries.*—*R. adenophorus* Rolfe, *R. coreanus* Miq., *R. idaeus*, *R. illecebrosus* Focke, *R. kuntzeanus* Hemsl., *R. lasiostylus* Focke, *R. leucodermis* Dougl., *R. mesogaeus* Focke, *R. occidentalis* L., *R. odoratus* L., *R. parviflorus* Nutt., *R. phoenicolasius* Maxim., *R. spectabilis* Pursh., *R. strigosus* Michx., *R. triphyllus* Thunb., *R. xanthocarpus* Bur. & Franch.

2n=21

(*a*) *Blackberries.*—Florida Marvel, numerous wild forms from New England and Maryland.

(*b*) *Raspberries.*—All Summer, Belle de Fontenay, Erskine, Merveille Rouge, November Abundance, White Queen.

(*c*) *Blackberry-raspberry hybrids.*—Kings Acre, Mahdi.

2n=28

(*a*) *Blackberries.*—*R. acuminatus* Lindeb., *R. affinis* Weihe & Nees., *R. arrhenii* J. Lange, *R. bloxamii* Lees, *R. caesius* L., *R. calvatus* Blox., *R. cletrophilus* Muell., *R. corylifolius* Sm., *R. genevieri* Muell., *R. hirtus* Waldst. & Kit., *R. imbricatus* Hort., *R. incurvatus* Bab., *R. insularis* Aresch., *R. kaltenbachii* Metsch., *R. lindleyanus* Lees, *R. nemorosus* Arrh., *R. nitidioides* Watson, *R. nitidus opacus* Focke, *R. pallidus* Weihe & Nees, *R. plicatus* Weihe & Nees, *R. polyanthemus* Lindeb., *R. radula* Weihe, *R. radula angustifolia* Lund., *R. schlechtendalii* Weihe, *R. sprengelii* Weihe, *R. strivultus* f. *kullensis*, *R. suberectus* Anders., *R. thyrsiger* Banning & Focke, *R. villicaulis* Koehl., Edward Langley, Evergreen, Himalaya, John Innes, Pollard, Sherlock Jr., Badger, Brainerd, Early Wonder, Eldorado, Johnson, Joy, Jumbo, La Grange, Lawton, Mersereau, Miller, Nanticoke, Queen, Snyder, Taylor, Texas Everbearing, Ward.

(*b*) *Raspberries.*—Hailsham, La France, Merveille Rouge, Merveille de Quatre Saisons, Surpasse Merveille Blanc.

(*c*) *Blackberry-raspberry hybrid.*—Veitchberry.

2n=35

(*a*) *Blackberries.*—*R. bellardi* Weihe & Nees.

2n=42

(*a*) *Blackberries.*—*R. borreri* Bell Salt, *R. ciliatus* Lindeb., *R. divergens* Neum., *R. wahlbergii* Arrh., *R. nitens* Lindeb., *R. tiliaceus* Liebm., Bedford Giant, *R. loganobaccus* Bailey, Loganberry, Cory, Erie, Lucretia, Mammoth, Phenomenal, Rathbun.

2n=45

Blackberry.—*R. eluxatus subnitidus* Lidf.

2n=49

Laxtonberry, *R. lagerbergii* Lindeb. var. *balticus* Aresh.
2n=56
Austin Thornless, Ideal Wild, Premo, Windom.
2n=84
R. macropetalus Dougl. of Oregon and Washington.

311. Darrow, G. M. 1937. Improvement of currants and gooseberries. *Yearb. U.S. Dep. Agric.*, pp. 534-44.

The history and development of currants are briefly reviewed and their relation to white pine blister rust considered. The red currant varieties Franco-German, Netherlands, and London Market are very resistant or nearly immune to the rust and cultivated varieties of gooseberries are very resistant. The Viking red currant is immune: a few open pollinated seedlings of Viking have shown slight susceptibility.

Brief descriptions of *Ribes sativum*, *R. rubrum*, *R. warscewiczii*, and *R. petraeum* complete this section.

The history and development of the gooseberry are briefly surveyed and ten species of gooseberry are described.

The origin of a number of the earlier varieties is given: Houghton arose in 1833 from a cross between a European and an American variety; Downing, which originated about 1855, is a seedling of Houghton; Oregon Champion, a cross between Crown Bob and Houghton, was raised about 1860; Pearl, from Downing × Red Warrington, was introduced in 1888; Red Jacket, from Houghton × Red Warrington, was introduced about 1890; Carrie, a seedling of Houghton, was introduced in 1905; Poorman, a seedling raised in Utah, was introduced in 1896; and Como, from Pearl × Columbus, was introduced in 1922. Of these varieties, Poorman (considered to be a cross between Downing and Houghton, though possibly it was a cross with one of the Rocky Mountain species) has the best appearance and is of excellent quality.

Glenndale stands hot summers better than other varieties and is resistant to leaf spot. Its parentage is ((*Grossularia missouriensis* × Red Warrington) × Triumph) × Keepsake.

Trebla is supposed to have been derived from *G. divaricata* × a cultivated gooseberry.

Fredonia, introduced in 1926, is a seedling of Crown Bob.

Houghton, Downing, Pearl, Carrie and Oregon are probably derived from crosses of *G. hirtella* (Michx.) Spach. with European varieties. *G. hirtella* has given mildew resistance to American varieties.

G. curvata (Small) Cov. & Britton is considered promising for breeding because of adaptation to southern conditions. *G. echinella* is promising for the same reason and because of its large fruits. *G. nivea* (Lindl.) Spach., the Snake River gooseberry, is especially promising for breeding.

The following gooseberry varieties have been introduced by Messrs. Laxton Bros.

Variety	*Introduced*	*Parentage*
Bedford Yellow	1915	Golden Drop × Drill
Amber	1916	Wonderful × Lancashire Lad
Bedford Red	1922	Crown Bob × Langley Green
Green Gem	1922	Drill × Whitesmith
Emerald	1925	Drill × Crown Bob
Golden Ball	1928	Drill × Whitesmith
Rearguard	1928	Wonderful × Lancashire Lad

312. Darrow, G. M., and **Clark, J. H. 1939.** The Sunrise red raspberry. *Circ. N.J. agric. Exp. Sta.*, **397,** 4 pp.

Sunrise, from Latham × Ranere, is an early, hardy, disease resistant, summer fruiting variety which occasionally produces a few berries in autumn.

Darrow, G. M. 1940. *See* **Williams, C. F.,** and **Darrow, G. M.**

Darrow, G. M. 1941. *See* **Waldo, G. F.,** and **Darrow, G. M.**

Darrow, G. M. 1941. *See* **Fischer, H. E., Darrow, G. M.,** and **Waldo, G. F.**

313. Darrow, G. M. 1942. Blackberry growing. *Fmrs' Bull. U.S. Dep. Agric.*, **1399,** 18 pp.

Darrow, G. M. 1943. *See* **Fischer, H. E., Darrow, G. M.,** and **Perlmutter, F.**

314. Darrow, G. M., Williams, C. F., and **Waldo, G. F. 1947.** Breeding studies in eastern states with the western trailing blackberries. *Proc. Amer. Soc. hort. Sci.*, **49,** pp. 186-8.

Some of the finest flavours in the blackberry-dewberry group are in the wild trailing blackberries of the Pacific coast region. Crosses were made between eastern varieties and the western trailing blackberry derivatives, Hunter (12*x*), Zielinski (12*x*), Pacific (9*x*), Ideal Wild (8*x*), Ware (8*x*), and Starr (8*x*). The most striking characteristic of the hybrids was the relatively high survival in the field of those having Lucretia (6*x*) as pollen parent (65%) as contrasted with those having Eldorado (4*x*) as pollen parent (29%). None of the 23 selections from these crosses was outstanding in comparison with Boysen and Young, though a few seemed more hardy.

Further crosses for hardiness have been Boysen (6*x*) × Austin Thornless (8*x*), and the reciprocal; Boysen × Brainerd (4*x*); Eldorado (4*x*) × Boysen. Most of these were nearly sterile; two selections, however, seemed hardier.

It is suggested that in making inter-group crosses, varieties with high chromosome numbers should be used, as there is possibly a differential survival rate between seedlings of higher and lower chromosome numbers.

Darrow, G. M. 1948. *See* **Waldo, G. F.,** and **Darrow, G. M.**

315. Darrow, G. M. 1948. Resistance of blackberries to cane rust at Beltsville, Maryland, 1947. *Plant Dis. Reptr.*, **32,** pp. 5-6.

Rating of varieties for reaction to *Kuehneola uredinis* (10=entirely free, 5=severe leaf damage, 1=parts of plant dying):

Variety	*Rating*	*Variety*	*Rating*
Austin Thornless	10	Merton Early	10
Boysen	10	Merton Thornless	10
Brainerd	10	Nanticoke	10
Burbank Thornless	10	Nessberry	10
Cameron	10	Oregon Evergreen	10
Cory (Bowen berry)	10	*Rubus* sp. 131870	10
Early Harvest	9	2 *R. pubescens*	10
Eldorado	3	*R. innominatus*	10
Foster	1	Texas 40-51 (Bigness)	10
Jumbo	1	,, 40-78	10
Kittatinny	3	,, 40-181	10
Lawton	1	,, 40-202 (Regalness)	10

316. Darrow, G. M. 1948. Growing erect and trailing blackberries. *Fmrs' Bull. U.S. Dep. Agric.*, **1995**, 34 pp.

This detailed account of the culture of erect and trailing blackberries includes a section on diseases and pests.

Practically all erect blackberry varieties that have no trailing blackberry parentage, and most varieties of trailing blackberries are entirely self-fertile. The McDonald, Mammoth, and some other varieties not so well known, however, are imperfect pollinizers under certain conditions. Early Wonder is suggested as a pollinator for McDonald. Premo, Rogers, and Advance are unfruitful when planted alone and should be planted with other varieties. Growers in California include two distinct varieties in what they term 'Advance'; these pollinate each other.

Erect, semi-erect, and semi-trailing varieties:

Alfred.—Michigan origin. Berries large, firm, sweet, very good quality; season a week earlier than Eldorado; hardy. Susceptible to orange rust.

Blowers.—New York origin. Berries large, firm and of good quality; early mid-season but spread out; hardy. Susceptible to orange rust.

Brainerd.—Originated from a cross between Himalaya and an eastern type. Berries are about 50% larger than those of Himalaya. Later than most erect varieties; hardy.

Crandall (*Macatawa*, *Everbearing*).—Texas origin. Berries large, firm, sweet and of very good quality; season very early and long; tender.

Dallas.—Texas origin. Berries large, firm, very good quality; early; semi-hardy.

Delsweet.—Semi-broadleaved sport of Evergreen producing berries of slightly better quality.

Early Harvest.—Illinois origin. Berries medium-sized, firm and of good quality; season early and long; not hardy; very susceptible to orange rust.

Early Wonder.—Texas origin. Berries medium-sized, firm, and of very good quality; medium early.

Eldorado (*Stuart*, *Lowden*, *Texas*).—Ohio origin. Berries medium-sized to large, firm, sweet, and of very good quality; season early to mid-season and long. Most resistant to orange rust of the widely grown varieties.

Evergreen (*Black Diamond*).—Origin unknown but grown in Europe since 1809. Berries large, exceptionally firm, sweet and of good quality; seeds large; season late to very late and long; drought resistant.

Haupt.—Texas origin. Berries large, fairly firm, good quality; very early; not hardy.

Himalaya (*Theodore Reimers*).—German origin. Berries medium-sized, sweet, rather soft but of good to very good quality; seeds large, season late; tender; immune to rosette (double blossom).

Iceberg.—California origin. Essentially a white-fruited Early Harvest. Berries are large, amber-white, soft and of very good quality; early mid-season; semi-hardy.

Lawton (*New Rochelle*).—New York origin. Berries large, soft, sweet, and of good quality; early mid-season; nearly hardy. Resistant to orange rust.

McDonald.—Texas origin; hybrid of erect and trailing blackberries. Berries large, firm, and of very good quality; very early. Bushes are drought resistant, self-sterile, tender.

Mersereau.—New York origin. Berries large, firm, sweet and of very good quality; early mid-season and a short season. Fairly drought resistant but susceptible to orange rust.

Nanticoke (*Hirschi*).—Maryland origin. Berries medium-sized, soft,

sweet and of very good quality; season very late and long; hardy, drought resistant, very thorny; suited to home use.

Snyder.—Indiana origin. Berries medium-sized, firm; good quality; season short; early mid-season; vigorous, hardy, not drought resistant, not producing many laterals; not adapted to heavy clay. Less susceptible to orange rust than most varieties.

Thornless Evergreen.—Thornless sport of Evergreen, propagated from tips because it comes thorny from roots.

Ward.—New Jersey origin. Berries large, firm, sweet, quality good; season late.

Trailing varieties:

Advance.—Consists of two components either of which alone is sterile. Berries are large, very firm, and of good quality; earliest variety of all in Florida. Very resistant to rosette (double blossom).

Boysen (*Boysenberry*, *Nectar*, *Rossberry*, *Lavaca*).—Origin unknown; berries somewhat larger, more acid and ripening 10 days later than Young; too soft for long distance travel.

Cascade.—Oregon origin, from Zielinski × Logan, introduced 1940. Berries resembling Pacific coast trailing blackberries; excellent flavour; bright deep red. Not hardy except in Pacific coast region; very productive; perfect flowered.

Cory Thornless (*Thornless Mammoth*, *Bowenberry*).—Thornless sport of Mammoth.

Franklin D.—If not identical with Boysen, then slightly less satisfactory.

Ideal Wild (*Santiam*).—Perfect flowered derivative of Pacific coast trailing blackberry. Berries smaller than Cascade or Pacific. Very susceptible to cane spot and leaf spot.

Johnson.—Possibly a cross between Logan and Pacific coast trailing blackberry. Berries rather small. Very susceptible to cane spot and leaf spot.

Logan (*Loganberry*).—California origin from Aughinbaugh Pacific coast trailing blackberry · raspberry (probably Red Antwerp). Berries large, long, dark red, a rich high flavour. Not hardy in eastern U.S., very productive.

Lucretia (*Bingleberry*).—W. Virginia origin, oldest of trailing blackberry varieties, brought to general notice about 1886. Berries large, long, firm; quality good. Season about June 1. Fairly hardy; susceptible to anthracnose and leaf spot.

Mammoth.—Probably a cross between Crandall and Aughinbaugh Pacific coast trailing blackberry. Self-sterile.

Mayes (*Austin Mayes*).—Texas origin; berries large with large drupelets; soft; good quality; at least a week earlier than Lucretia. Susceptible to anthracnose and rosette (double blossom).

Nectar.—Reported to be a seedling of Young, but almost or quite identical with Boysen.

Pacific.—Oregon origin from Zielinski × Logan; berries somewhat larger than Cascade and well flavoured but plant not as vigorous and of less value.

Rogers.—Similar to Advance; canes red hairy like those of southern coastal trailing blackberry.

Thornless Boysen.—All plants of this proved to be Thornless Young.

Thornless Logan.—Thornless sport fully as good as the logan; productive; root cuttings always thorny.

Thornless Young.—Similar to Young except for absence of thorns; leaves usually more cupped than those of Young.

Young (*Youngberry*).—From Phenomenal × Mayes about 1905, introduced 1926. Berries larger than Lucretia, deep wine colour, much sweeter than Logan, Boysen, and Lucretia; one of best of all blackberries for freezing and jam; good dessert quality. Season similar to Lucretia but continuing 10 days longer. Not as hardy as Lucretia. Somewhat resistant to anthracnose and leaf spot; susceptible to rosette (double blossom).

Zielinski.—Pistillate variety derived from Pacific coast trailing blackberry; pollinators such as Ideal Wild, Young or Logan are necessary.

317. Darrow, G. M. 1949. Polyploidy in fruit improvement. *Proc. Amer. Soc. hort. Sci.*, **54,** pp. 523-32.

A general discussion of the significance and utilization of polyploidy in top and bush fruits.

Darrow, G. M. 1949. *See* **Williams, C. F., Smith, B. W.,** and **Darrow, G. M.**

318. Darrow, G. M. 1952. *Rubus glaucus*, the Andes blackberry of Central America and northern South America. *Ceiba,* **3,** pp. 97-101. (From *Hort. Abstr.*, **24,** p. 340.)

R. glaucus grows at 6,000-10,000 ft; its fruits, of similar colour to Youngberry, are larger than Boysenberry and have a better flavour and appearance because the drupelets and seeds are smaller.

319. Darrow, G. M. 1953. Breeding of small fruits in the United States. *Rep. 13th int. hort. Congr.*, London, pp. 577-86.

The work of the U.S. experiment stations in this field is briefly reviewed, large numbers of individual workers being named.

Darrow, G. M. 1954. *See* **Morrow, E. B., Darrow, G. M.,** and **Scott, D. H.**

Darrow, G. M. 1954. *See* **Scott, D. H.,** and **Darrow, G. M.**

320. Darrow, G. M. 1955. Blackberry-raspberry hybrids. *J. Hered.*, **46,** pp. 67-71.

Hybrids between the 2*x* erect-growing blackberry Early Harvest ♀ and 2*x* red raspberries ♂ were vigorous and mostly non-suckering, though both parents suckered freely; over half were pistillate, though neither parent was pistillate. The leaves of 38 out of the 43 seedlings were free from any leaf disease. Anthracnose attacked only 5 seedlings although it was prevalent on red raspberry canes planted amongst the hybrids. None of the seedlings was very prickly. Thirty-three had green abaxial leaf surfaces and 10 had whitish surfaces (intermediate between the parents). Two fertile seedlings were obtained but the fruit did not separate from the stem or from the receptacle so that they were of no direct commercial value.

Crosses of two 4*x* red raspberries ♀ (Colossus and Hailsham) with a 4*x* derivative of Eldorado as pollen parent, yielded 7 seedlings all of which died.

The paper includes a review of previous work on crossing blackberries

with raspberries in which the parentage of Loganberry (6*x*) is given as 8*x* Aughinbaugh (Pacific coast trailing blackberry) × a 2*x* pollen grain of Antwerp raspberry. The Phenomenal (6*x*) is of similar origin (Aughinbaugh × Cuthbert). Primus is Aughinbaugh × Siberian raspberry (*R. crataegifolius*), according to Burbank who also reported successful hybrids of Lawton blackberry (? 4*x*) × Golden Queen raspberry (2*x*) and of Crystal White blackberry (2*x*) with Shaffer raspberry (2*x*)—Paradox, a variety with light red berries, arose from this cross. The Nessberry (4*x*) arose from the cross *R. rubrisetus* (= *trivialis*) × Brilliant red raspberry (2*x*). Yarnell obtained fertile diploids from the cross Nessberry (4*x*) × dewberry (2*x*); these were named Earli-Ness, Big-Ness, and Regal-Ness. The Youngberry arose from the cross Phenomenal (6*x*) × Mayes dewberry and the Boysen is considered to have had a similar origin. Waldo crossed 8*x* trailing blackberries with 4*x* La France and grew several hundred seedlings. He also grew hybrids of Zielinski (12*x*) × Logan (6*x*), and of Black Logan (6*x*) × Young (6*x*). Cascade (9*x*) arose from the former cross. Magnaberry is from Nessberry (4*x*) × Sodus raspberry (2*x*) F_3. In Europe, a triploid idaeus-caesius is common; Gustafsson considers *R. caesius* to be a hybrid of blackberry, raspberry, and *R. saxatilis*. Breeding behaviour of *R. ursinus* shows it to have a red raspberry genom in its make-up.

The Mahdiberry (3*x*) is *R. rusticanus* (2*x*) × Belle de Fontenay (4*x*) raspberry; Laxtonberry (7*x*) is Logan × Superlative (2*x*) raspberry; Veitchberry (4*x*) is English blackberry (2*x*) × November Abundance (4*x*). Porpaczy crossed Lloyd George with the European dewberry (*R. caesius*, 4*x*), and crossed a selected F_1 plant with Logan. He named the hybrid *R. mohacsyanus*.

321. Darrow, G. M. 1955. The giant Colombian blackberry of Ecuador. *Fruit Var. hort. Dig.*, **10**, pp. 21-2.

The Colombian blackberry (*Rubus macrocarpus*) and related species may prove useful in breeding, contributing such characters as very large fruits, vigour, short-day adaptation, and disease resistance.

322. Datta, S. 1932. Some chromosome numbers in British species of *Rubus*. *Mem. and Proc. Manch. lit. and phil. Soc.*, **76.**

323. Davis, M. B. 1926. Gooseberry breeding. *Rep. Domin. Horticulturist for 1925*, Dep. Agric. Canada, pp. 11-14.

The variety Spinefree is practically thornless and spineless and bears fruit of commercial size. It was obtained by crossing a thornless plant of *Ribes oxyacanthoides* with Victoria (*R. grossularia*). A thornless segregate selfed out of this cross was crossed with Mabel, and from this arose the variety Spinefree.

The varieties Chautauqua, Clark, Oregon Champion, Poorman, and Van Fleet are described.

324. Davis, M. B. 1926. *Rubus* breeding. *Rep. Domin. Horticulturist for 1925*, Dep. Agric. Canada, pp. 10-11.

Out of 101 loganberry-raspberry hybrids, none proved fertile though a few drupelets set on each plant. In crosses of red raspberry with Royal Purple, purple, dark red, and bright red fruits were recovered and in most cases the fruits were very firm and of good size. Both suckering and non-suckering individuals were obtained. Of 18 non-suckering, red-fruited

segregates only one could be propagated by tip layering, the balance refusing to propagate by any means.

Davis, M. B. 1943. *See* **Hunter, A. W. S., and Davis, M. B.**

325. Dementjeva, M. I. 1953. (Resistance of gooseberry to a group of diseases.) (*Proc. Lenin Acad. agric. Sci.*) No. 6, pp. 32-4. (From *Plant Breed. Abstr.*, **24,** p. 461.)
At the Timirjazev Agricultural Academy, the gooseberries Mičurinskiĭ, Black Negus, Houghton, Carrie, Pjatiletka, Mysovskiĭ 17, and Mysovskiĭ 37 showed a high degree of resistance to *Sphaerotheca*, *Botrytis*, *Gloeosporium*, *Puccinia*, and a physiological wilt. Varieties resistant to any one of the above diseases are thought to be resistant to all the others.

326. Detjen, L. R. 1916. Self-sterility in dewberries and blackberries. *Tech. Bull. N.C. agric. Exp. Sta.*, **11,** pp. 5-37. (Reported by A. B. Stout, 1920, *J. Genet.*, **9,** p. 89.)
Eleven cultivated varieties, directly derived from the blackberry and propagated vegetatively, were found to be self-compatible, while of twelve varieties descended from the dewberry ten are self-incompatible. Wild plants of the blackberry (*Rubus villosus*) were found to be self-compatible. Thus it appears that *R. villosus* is a self-compatible species while *R. trivialis* is strongly self-incompatible.

Of the varieties known to be hybrids between these two species, three (McDonald, Sorsby, and Spalding) are self-incompatible and one (Rathbun) is partially self-incompatible. The self-incompatibility characteristic of one parent appears in various degrees in the different individuals of the F_1. It is reported that the self-compatible plants when self-pollinated 'produce apparently as good fruits as when cross pollinated'. In regard to cross-compatibility it is reported that most crosses give successful fertilization.

In addition to sterility from physiological incompatibility, certain hybrid varieties of the dewberry-blackberry cross are more or less sterile from impotence of sex organs.

327. Detjen, L. R. 1920. A mutating blackberry-dewberry hybrid. *J. Hered.*, **11,** pp. 92-4.
A cut-leaved plant arose as a bud mutation from what appeared to be a blackberry-dewberry hybrid.

328. Detwiler, S. B. 1931. The effect of ultra-violet light on germination of seeds and growth of seedlings of *Ribes rotundifolium* Michx. *J. For.*, **29,** pp. 131-3. (Condensed from *Exp. Sta. Rec.*, **64,** p. 540.)
Exposure of dry seeds of *R. rotundifolium* to ultra-violet light of a wave length of 2,700 to 3,200 ångstrom units for 5, 10, and 20 min. prior to planting in sterilized soil proved harmful in every case. The untreated seeds germinated earlier, although no better in greenhouse tests. There was a pronounced stunting, but after 17 weeks all differences in vigour caused by the light had disappeared.

329. Dicker, G. H. L. 1940. The biology of the *Rubus* aphids. *J. Pomol.*, **18,** pp. 1-33.

330. Dickey, R. D. 1948. Blackberry culture in Florida. *Press Bull. Fla agric. Exp. Sta.*, **657.**

Dickey, R. D. 1954. *See* **Sharpe, R. H.,** and **Dickey, R. D.**

331. Dickson, B. T. 1923. Raspberry mosaic and curl. *Sci. Agric.*, **3,** pp. 308-10. (Condensed from *Rev. appl. Mycol.*, **2,** pp. 547-8.)
Of the varieties commonly grown, St. Regis and Sunbeam seem least susceptible to mosaic. The vector is probably *Aphis rubiphila.*

Columbian and Newman Nos. 1, 23, and 24 are resistant to leaf curl. *Aphis rubiphila* is the vector.

332. Dodge, B. O. 1923. Morphology and host relations of *Pucciniastrum americanum. J. agric. Res.*, **24,** pp. 885-94.
This paper records the occurrence in America of *P. americanum* on numerous species and varieties of *Rubus* including cultivated red, purple, and black varieties.

333. Dodge, B. O. 1923. Systemic infections of *Rubus* with the orange rusts. *J. agric. Res.*, **25,** pp. 209-42. (Condensed from *Rev. appl. Mycol.*, **3,** pp. 280-1.)
The sporophytic stage of *Gymnoconia interstitialis* was found to be transmissible in nature from the mountain blackberry (*R. canadensis*) to cultivated varieties of blackberry and loganberry. Lawton blackberry appears immune, and Snyder very resistant, to orange rust. In N. Carolina the Lucretia dewberry approaches complete immunity. The southern dewberry (*R. enslenii*), which is susceptible to the short-cycled rust ('*Kunkelia nitens*'), was readily infected by sowing aecidiospores of the long-cycled *Gymnoconia* from *R. occidentalis* on the leaves.

Considerable differences in varietal response to the two rusts are believed to exist. Iceberg blackberry is very susceptible to the short-cycled form from blackberry but is highly resistant to the long-cycled form from the wild dewberry.

Doesburg, J. J. 1955. *See* **Kronenberg, H. G.,** and **Doesburg, J. J.**

334. Dorsey, M. J. 1921. Hardiness from the horticultural point of view. *Proc. Amer. Soc. hort. Sci.*, **18,** pp. 173-8.
This paper includes a study of seedlings of wild raspberries from Manitoba. Differences in hardiness were recorded in 1919-20, but in 1920-21 all were frozen to the ground. The seedlings showed much variation in smoothness of cane, colour of spines, and colour and size of fruit.

335. Dorsey, M. J., and **Haralson, C. 1921.** Which are the hardy varieties of raspberries, blackberries, and dewberries? *Minn. Hort.*, **49,** pp. 161-5.
Latham, King, and Sunbeam red raspberries proved hardy.

336. Drain, B. D. 1938. The breeding of small fruits for the South. *Proc. 39th annu. Convent. Ass. S. agric. Wkrs, Atlanta, Ga*, pp. 108-9. (Condensed from *Plant Breed. Abstr.*, **9,** pp. 239-40.)
A review of the techniques employed in small fruit breeding at the Tennessee Agricultural Experiment Station. Hybridization of heterozygous

material gives quick results but has many failings—the chance of eliminating all undesirable genes is very small, and inbreeding followed by recombination of inbred lines would in theory be better. Selfing raspberries gives a striking loss of vigour and many seedlings and even entire lines are lost.

337. Drain, B. D. 1939. Red raspberry breeding for southern adaptation. *Proc. Amer. Soc. hort. Sci.*, **36**, pp. 302-4.

Van Fleet, a cross between Cuthbert and *Rubus kuntzeanus*, is well adapted to the southern U.S. but its fruit is of low quality. Selfing gave a population of which more than 90% were discarded because of mosaic and which had fruit of low quality. Backcrossing with commercial varieties such as Viking, Chief, Cayuga, and Latham produced lines more resistant to mosaic, but in general more susceptible to leaf spot (*Septoria rubi* Westd.) and with fruit still of too low quality.

Families carrying one quarter *R. kuntzeanus* blood showed leaf spot in 22% but mosaic in less than 50% of the plants. Over 40% of this population showed fruit which was not red; 5% were large fruited and less than 20% had coherent drupelets; 11% had good flavour and 19% showed firm fruit (as did Lloyd George). The more promising seedlings were chosen for backcrossing to Lloyd George. In this cross, carrying one-eighth *R. kuntzeanus* blood, 24% had large fruit, 31% had coherent drupelets, and almost all were red fruited; 21% were selected as being superior, compared with 2% in the previous backcross. There was much pollen sterility in these hybrids.

338. Drain, B. D. 1940. Tennessee Autumn red raspberry. *Circ. Tenn. agric. Exp. Sta.*, **70**, 4 pp.

Tennessee Autumn red raspberry, (Latham × Van Fleet) × Lloyd George, is cold resistant, escapes mosaic and leaf curl, and is only slightly susceptible to cane spot. It ripens in late May to June and September to October.

339. Drain, B. D. 1943. Breeding for adaptation of the strawberry and raspberry. *Trans. Ill. St. hort. Soc.* **77**, pp. 216-18.

Includes a brief account of raspberry breeding in Tennessee.

340. Drain, B. D. 1945. Tennessee Luscious red raspberry. *Circ. Tenn. agric. Exp. Sta.*, **92**, 4 pp.

Tennessee Luscious is derived from Lloyd George × Tennessee seedling VVF 169, itself derived from Van Fleet × Viking.

341. Drain, B. D. 1948. Tennessee Prolific red raspberry. *Circ. Tenn. agric. Exp. Sta.*, **101**, 4 pp.

Tennessee Prolific, from Lloyd George × Tennessee seedling VVF 169, carries blood of *Rubus idaeus*, *R. kuntzeanus* and *R. idaeus* var. *strigosus*. It is late, large fruited, and particularly suited to frozen packing. Tennessee Luscious was selected from the same progeny as Prolific.

342. Drain, B. D. 1952. Some inheritance data with black raspberries. *Proc. Amer. Soc. hort. Sci.*, **60**, pp. 231-4.

Data are given for the inheritance of fruit and seed characters in the crosses Pristol × Black Beauty, Bristol × Honey Sweet, Logan × Bristol, Cumberland × Logan, Bristol × Logan, Bristol × Cumberland, and Cumberland × Bristol. The fruit is classified for form and size, size of seed, drupelet number, drupelet size, bloom, colour, receptacle (whether cling

or free; large, medium or small), flesh quality (dry, medium, juicy), flavour, and finally shipping quality (firm, medium, or soft).

343. Dubois, C. W. 1941. Freezing your winter's supply of fruits and vegetables. *Fm Res. N.Y.*, **7** (3), pp. 8-9.
The following varieties of raspberry are the most satisfactory for freezing: purple: Sodus and Columbian; red: Cuthbert, Viking, Taylor, Marcy, Indian Summer; black: Bristol.

344. Duka, A. Kh. 1940. (A new form of berry. Black currant × gooseberry.) *Jarovizacija* No. 3 (30), pp. 119-22. (From *Plant Breed. Abstr.*, **11**, p. 231.)
Mixed pollen of a number of species of gooseberry was applied to black currants, giving rise to 37 hybrid seedlings all of which were spineless and lacked the characteristic black currant smell. One of these fruited abundantly, the fruits, 1-3 per strig and up to 2 cm. long with a diameter of 1·5 cm., were seedless. The hybrid is readily multiplied by cuttings.

Eggert, R. 1945. *See* **Yeager, A. F., Latimer, L. P.,** and **Eggert, R.**

345, Einset, J. 1947. Chromosome studies in *Rubus*. *Gentes Herbarum*, **7,** pp. 181-92.
The following somatic chromosome numbers were found: Hispidi—*Rubus signatus* 21, *R. plus* 21, *R. huttonii** 28; Setosi—*R. dissensus* 21, *R. bootianus** 14, *R. jejunus* 28; Flagellares—*R. flagellaris* 63, *R. minnesotanus** 35, *R. noveboracus* 35, *R. meracus* 49, *R. plicatifolius** 63; Cuneifolii—*R. serissimus** 28; Canadenses—*R. canadensis* 21; Allegheniense—*R. allegheniensis* 14, *R. pugnax* 14, *R. rosa** 21; Arguti—*R. abactus* 35, *R. bellobatus* 21, 28, *R. avipes** 21, *R. localis** 21, *R. hanesii** 28, *R. uniquus* 28, *R. cardianus** 35, *R. wiegandii** 36, *R. pensilvanicus* 28; Idaeobatus—*R. strigosus* 21.

There was no significant difference in size between chromosomes of different species, individual chromosomes measuring between 1 and 4 μ.

An examination of meiotic behaviour in thirteen of these species showed that only two diploids, *R. allegheniensis* and *R. pugnax*, have completely regular behaviour; the remainder marked in the above list with asterisks showed various degrees of irregularity. The fairly high percentage of multivalents formed in some tetraploid species indicates that auto- as well as allo-tetraploidy may have occurred.

346. Einset, J. 1951. Apomixis in American polyploid blackberries. *Amer. J. Bot.*, **38,** pp. 768-72.
Somatic chromosome counts were made of 1,620 seedlings obtained by selfing, crossing or open pollinating the following polyploid American blackberries: *R. canadensis* 21, *R. rosa* 21, *R. bellobatus* 21, Kittatinny 21 (probably *R. bellobatus*), *R. localis* 21, *R. abactus* 21, *R. huttonii* 28, *R. allegheniensis* 28, *R. hanesii* 28, *R. noveboracus* 35, *R. cardianus* 35, *R. wiegandii* 36, *R. geophilus* 49, *R. meracus* 49, *R. flagellaris* 63.

All species produced a high proportion of apomictic seedlings with chromosome numbers like those of the seed parents. This was true after selfing, crossing with plants having different chromosome numbers, or on open pollination. Apparently these seedlings were produced pseudogamously from unreduced eggs. Numerous cases of reduced parthenogenesis also were observed, notably in the tetraploid 28-chromosome species where 43 individuals with 14 somatic chromosomes were found

in a population of 681 seedlings. Hybrid seedlings resulted infrequently after fertilization of reduced or unreduced eggs.

347. Einset, J., and **Pratt, C. 1953.** A blackberry-raspberry cross—a new fruit for the East? *Fm Res. N.Y.*, **19** (4), p. 3.
A highly fertile 4*x* hybrid between Hailsham red raspberry and Eldorado blackberry is reported.

348. Einset, J., and **Pratt, C. 1954.** Hybrids between blackberries and red raspberries. *Proc. Amer. Soc. hort. Sci.*, **63,** pp. 257-61.
Diploid red raspberry × *Rubus allegheniensis* 2*x*: Thirteen crosses gave a total of 4,016 seeds (7·7 seeds per flower) and 80% of the seeds were 'filled'. Germination was good but plants died at about the 4th leaf stage (*c.* 1 in. high). Of 559 seedlings only 8 made enough growth for chromosome examination of root tips and two of these proved to be raspberry selfs. One plant, a 2*x* hybrid, showed fair vigour.

Diploid red raspberry × 4*x* blackberry (Kittatinny, Ancient Briton, Erie, and Eldorado): Five different raspberries were used as females; out of 11,039 seeds produced (15·3 per flower) 130 seedlings were obtained. These were vigorous but sterile triploids; some tetraploids were obtained which showed good yield and these may be of value in breeding.

Tetraploid red raspberry (Hailsham) × *R. allegheniensis* 2*x*: Only 72 seeds were obtained (0·7 per flower). Germination was nil in the first lot sown and data are not yet available for the remainder.

Tetraploid red raspberry × 4*x* blackberry (Erie and Eldorado): 1,775 seeds were obtained (7·9 per flower). Although *c.* 90% of the seeds appeared well filled, germination was below 20%. Most seedlings were poor in vigour but about 10% were vigorous. Some of the plants were 4*x*; one plant with 31 chromosomes died, and of the two plants with 42 chrosomes one died and the other appeared to be of 4R+2B genomic constitution.

R. allegheniensis 2*x* × 2*x* red raspberry: 1,316 seeds were produced (2·3 per flower); these were well filled but only 6·9% germinated. The seedlings were poor.

R. allegheniensis 2*x* × 4*x* red raspberry: 12 seeds (0·1 per flower) were produced but none germinated.

Tetraploid blackberry (Ancient Briton and Kittatinny) × 2*x* red raspberry: 69 seeds (0·6 per flower) were obtained, 9 germinated and showed fair vigour.

Tetraploid blackberry × 4*x* red raspberry: 46 seeds were obtained (0·2 per flower) but data on germination are not yet available.

Hybrid fruits: Four 4*x* seedlings of Hailsham (4*x*) × Erie (4*x*) produced abundant fruit in 1953. The fruit was 1·1-2·6 cm. long, very dark red and densely pubescent.

A 4*x* seedling of Newburgh (2*x*) × Erie (4*x*) produced abundant fruit 1·2-1·7 cm. long with almost black puberulent, but still somewhat lustrous, fruit which 'plugged'. A 4*x* seedling of Latham (2*x*) × Ancient Briton (4*x*) had dark red fruits otherwise similar to those of the preceding plant.

Einset, J. 1955. *See* **Pratt, C.,** and **Einset, J.**

349. Engard, C. J. 1944. Organogenesis in *Rubus*. *Res. Publ. Univ. Hawaii, Honolulu,* **21,** 234 pp.

350. Evréinoff, V. A. 1936. *Ribes procumbens* Pall. (Groseillier rampant). *Bull. Soc. nat. Hort. Fr.*, **3**, p. 128.

351. Evréinoff, V. A. 1939. (Origin and ancestors of the cultivated *Ribes*.) *Bull. Soc. nat. Hort. Fr.*, **6**, pp. 135-42.
The author considers that most of the cultivated forms arose from *R. vulgare*. A new scheme of classification of the cultivated varieties is given, based on the structure of flower, leaf, fruit, and fruit cluster.

352. Evréinoff, V. A. 1940. (A tentative classification of our currant varieties.) *Fruit belge*, **8**, pp. 5-11.

353. Evréinoff, V. A. 1942. (The blue currant, *Ribes dikuscha* Fisch.) *Rev. hort., Paris*, **28**, pp. 46-7.
R. dikuscha appears immune from fungus diseases such as *Cronartium ribicola* and tolerant of extreme frost.

354. Evréinoff, V. A. 1945. (Origin and ancestors of our currant bushes.) *Rev. hort., Paris*, **29**, pp. 203-5.

355. Evréinoff, V. A. 1955. (The black currant. Pomological notes.) *Rev. hort., Paris*, **127**, pp. 1266-7. (From *Plant Breed. Abstr.*, **26**, p. 104.)
Data are presented on the morphology of leaves, clusters and fruits of the different botanical varieties and cultivated forms.

Farago, M. 1950. *See* **Porpaczy, A.,** and **Farago, M.**

Farley, A. J. 1913. *See* **Blake, M. A., Farley, A. J.,** and **Connors, C. H.**

356. Fassett, N. C. 1941. Mass collections: *Rubus odoratus* and *R. parviflorus*. *Ann. Mo. bot. Gdn*, **28**, pp. 299-374.
Both *Rubus odoratus* and *R. parviflorus* show variation in the glands and pubescence of calyces, pedicels, petioles, blades and stems. With the exception of *R. parviflorus* var. *velutinus* the various combinations of types of pubescence and glands are treated as forms.
In *R. odoratus* the percentage of individuals with essentially glabrous leaves increases progressively from West Virginia to Maine. Colonies in southern Indiana, probably isolated since before the earlier Pleistocene glaciations, show relationship most distant from eastern colonies.
In *R. parviflorus* most of the recently proposed varieties, with the exception of var. *velutinus*, appear invalid.

357. Ferguson, W., Spangelo, L. P., and **Cameron, D. F. 1951.** Horticultural plant breeding in Canada. *Z. Pflanzenz.*, **30** (1), pp. 18-25.
Brief reference is made to soft fruits.

358. Fischer, H. E., Darrow, G. M., and **Waldo, G. F. 1941.** Further chromosome studies of some varieties of blackberries. *Proc. Amer. Soc. hort. Sci.*, **38**, pp. 401-4.
The chromosome numbers of selections from the wild and of named commercial varieties of blackberries are reported. Of the wild selections from N.W. California, western Oregon and Washington, five were 6*x*,

eight were 8*x* and three were 12*x*. Early Harvest (*Rubus floridus* Tratt.) was 2*x*, Oregon No. 157 (Logan × Himalaya) was 5*x*, Boysen 6*x*, Logan 6*x*, Pacific (Zielinski 12*x* × Logan 6*x*) was 9*x*, and Cascade (origin as for Pacific) 9*x*.

Meiosis in Pacific and Cascade proved remarkably regular, univalents and microcytes being rare. Since these two varieties and other selections made at Oregon contain an odd number of chromosome sets, it is argued that in these high degrees of polyploidy numerical hybridity has little effect on fertility.

359. Fischer, H. E., Darrow, G. M., and **Perlmutter, F. 1943.** Raspberry and blackberry breeding: production of tetraploid raspberries. *Proc. Amer. Soc. hort. Sci.*, **42,** pp. 447-56.

Some 2,500 raspberry seedlings at the green cotyledon stage were soaked in 0·2-0·5% aqueous colchicine for 5-24 hr. Seventeen partially or completely tetraploid plants were obtained. Nine of these were of (*R. idaeus* × *R. strigosus*) × *R. parvifolius* parentage and here doubling did not appreciably increase fertility. However, fertile plants of this cross were selected from amongst undoubled material.

360. Fivaz, A. E. 1931. Longevity and germination of seeds of *Ribes*, particularly *R. rotundifolium*, under laboratory and natural conditions. *Tech. Bull. U.S. Dep. Agric.*, **261,** 40 pp. (Condensed from *Exp. Sta. Rec.*, **66,** pp. 48-9.)

Seeds of *Ribes* species, particularly *R. rotundifolium*, remain dormant in forest litter for long periods, germinating after disturbances such as forest fires, logging operations and windfalls. Such germinations depend on soil cover disturbances rather than on light change. In laboratory tests, *R. rotundifolium* and *R. cynosbati* germinated best when subjected to alternating temperatures—a daily alternation of from 10° to 25° C. was most effective. Germination was also improved in peat when calcium carbonate was added, suggesting that soil reaction is important.

361, Fluiter, H. J. de, and **Thung, T. H. 1951.** (Observations on *Rubus* stunt in raspberry and wild blackberry. I.) *Tijdschr. PlZiekt.*, **57,** pp. 108-14.

Fluiter, H. J. de. 1951. *See* **Kronenberg, H. G.,** and **Fluiter, H. J. de**

362. Fluiter, H. J. de, and **van der Meer, F. A. 1952.** (Observations on several aphids of raspberry and blackberry.) *Versl. 84 ste Winterverg. Ned. Ent. Ver.*, pp. 107-12.

363. Fluiter, H. J. de., and **van der Meer, F. A. 1953.** *Rubus* stunt, a leaf-hopper borne virus disease. *Tijdschr. PlZiekt.*, **59,** pp. 195-7.

Rubus stunt occurs in wild and cultivated raspberries and in wild blackberries in Holland. It is carried by *Macropsis fuscula* Zett. (*M. rubi* Boh.). Symptoms appeared on Norfolk Giant and Radboud four months after graft inoculations.

364. Fluiter, H. J. de, and **van der Meer, F. A. 1955.** (*Rubus* stunt disease of raspberry, its spread and control in the Netherlands.) *Meded. LandbHoogesch. Gent*, **20** (3), pp. 419-34.

Rubus stunt, found on both cultivated raspberries and wild blackberries

in Holland, is carried by the leaf hopper *Macropsis fuscula* Zett., a brief life history of which is given.

Infection occurs in July, August and September and symptoms develop after a year.

Heat treatment of $1\frac{1}{2}$-2 hours in water at 45° C. destroys the virus.

Larval and adult leaf hoppers transferred from blackberry to raspberry and vice versa soon died. There are, therefore, probably two strains of the vector which explains the lack of correlation between the occurrence of *Rubus* stunt on wild blackberry and cultivated raspberry.

365. Focke, W. O. 1877. Synopsis *Ruborum Germaniae*. Bremen.

366. Focke, W. O. 1890. Notes on English *Rubi*. *J. Bot.*, **28,** pp. 129-35.

367. Focke, W. O. 1896. (On *Rubus melanolasius* and other sub-species of *Rubus idaeus*.) *Sonder-Abd. a. d. Abh. d. Naturw. Ver. z. Bremen*, **13,** pp. 469-74.

368. Focke, W. O. 1902-1904. *Rubus*. In Ascherson und Graebner, *Synops. Mitt.-Europ. Flora*, **6,** 1. Leipzig.

369. Focke, W. O. 1910. Species *Ruborum*. I. *Bibl. Bot.*, **72,** pp. 1-120.

370. Focke, W. O. 1911. Species *Ruborum*. II. *Bibl. Bot.*, **72,** pp. 121-223.

371. Focke, W. O. 1914. Species *Ruborum*. III. *Bibl. Bot.*, **83,** pp. 1-274.

French, A. P. 1943. *See* **van Meter, R. A.,** and **French, A. P.**

French, A. P. 1944. *See* **Bailey, J. S., French, A. P.,** and **van Meter, R. A.**

French, D. W. 1955. *See* **Anderson, R. L.,** and **French, D. W.**

372. Friderichsen, K. 1897. Contribution to the knowledge of the *Rubi corylifolii*. *Centbl.*, **70,** *No. 11-12*, pp. 340-50.

Galey, D. O. 1951. *See* **Zielinski, Q. B.,** and **Galey, D. O.**

373. Gardner, M. W. 1929. Indiana plant diseases, 1927. *Proc. Indiana Acad. Sci.*, **38,** pp. 143-57.

London Market currant and Plum Farmer black raspberry showed resistance to *Pseudopeziza ribis* and *Plectodiscella* [*Elsinoë*] *veneta* respectively.

374. Garner, R. J., and **Hammond, D. H. 1939.** Leaf-bud propagation of Loganberry, Youngberry and blackberries. *Rep. E. Malling Res. Sta. for 1938*, pp. 218-22, and *Gdnrs' Chron.*, **105,** pp. 9-11.

Leaf-bud propagation proved successful with Cumberland black raspberry, Himalaya, Parsley Leaved blackberry, Loganberry, and Youngberry. Repeated attempts to strike leaf-bud cuttings of Lloyd George failed. The method of raising the cuttings is described.

Garner, R. J. 1937. *See* **Pearse, H. L.,** and **Garner, R. J.**

375. Genevier, G. 1880. (Monograph of *Rubi* of the basin of the Loire.) Paris.

376. Georgeson, C. C., *et al.* 1911. Horticultural investigations in Alaska. *Rep. Alaska agric. Exp. Sta.*
The cross Cuthbert × Salmonberry (*Rubus spectabilis*) proved of no material value.

377. Georgeson, C. C., *et al.* 1915. *Rep. Alaska agric. Exp. Sta.*
Raspberry-salmonberry hybrids were of no value; hybrids between raspberry and the thimbleberry (*Rubus parviflorus*) have been obtained.

378. Gerritsen, J. D. 1946. (Problems about the leaf-spot of red currants.) *Tijdschr. PlZiekt.*, **52,** pp. 119-20. (Condensed from *Plant Breed. Abstr.*, **17,** p. 219.)
The fungus (*Pseudopeziza ribis* Kleb.), causing leaf-spot of red currants, also attacks white and black currants and gooseberries. The red currant is the most susceptible, but there are large differences in varietal susceptibility, e.g. Fay's Prolific, Versailles and Laxton No. 1 are very sensitive, while Prince Albert and Earliest of Fourlands are resistant. The last two varieties are derived from *Ribes petraeum*, and Fay's Prolific and Versailles from *R. vulgare*.

379. Gloyer, W. O. 1925. Report of plant disease. *Proc. N.Y. St. hort. Soc.*, **70,** pp. 23-9. (Condensed from *Rev. appl. Mycol.*, **5,** pp. 20-1.)
In New York roguing and the use of healthy stock successfully controlled mosaic on Cuthbert, Columbian, June, Ontario and Owasco, but not on Cayuga, Latham, Marlboro and Seneca. In the Hudson Valley the spread of the disease is remarkably rapid except on Newman; Herbert, Ranere and Erskine Park are also comparatively resistant.

380. Goff, E. S. 1900. Effects of the February freeze of 1899 upon nurseries and fruit plantations in the Northwest. *Bull. Wis. agric. Exp. Sta.*, **77,** 18 pp. (Condensed from *Exp. Sta. Rec.*, **11,** pp. 930-1.)
Loudon endured cold better than most other red raspberries, though several withstood −50° F. at Manitoba without protection. Of the blackcaps, Older proved most hardy. Blackberries generally suffered severely, though Snyder showed hardiness in many cases.

381. Goff, E. S. 1901. Investigation of flower buds. *Rep. Wis. agric. Exp. Sta.*, pp. 304-16. (Condensed from *Exp. Sta. Rec.*, **13,** p. 917.)
The buds of Pomona currant showed an early stage of flower formation on 8 July, those of Victoria black currant on 3 August, and those of Downing gooseberry on 30 August. Buds of the latter taken 20 October showed ovules—one of the few instances where ovules have been observed in autumn. Raspberry and blackberry form their flower buds in the season in which they flower [cf. Mathers, 1952].

382. Golubinsjkiĭ, I. M. 1951. (The effect of volatile substances emanating from flowers upon the growth of pollen grains in angiosperms.) *Bot. Ž.* (Bot. J.), *Kiĭv*, **7** (4), pp. 61-6. (Condensed from *Plant Breed. Abstr.*, **23,** p. 623.)
Pollen growth of black currant was intensified in artificial media to which petals or whole flowers of the same species had been added.

383. Gomoljako, L. J. 1941. (A new source of carotene (Provitamin A).) *C.R. (Doklady) Acad. Sci., U.S.S.R.*, **32,** pp. 142-3. (From *Exp. Sta. Rec.*, **88,** p. 855.)
Fruits of the golden currant (*Ribes aureum*), as grown in various European botanic gardens and including two seedlings from N. America, were studied. Of the 15 samples investigated, 9 appeared satisfactory from the standpoint of flavour and odour, and these upon analysis gave the following range of values: dry matter 14·2-23·0%, ascorbic acid 32·5-58·4 mg. %, carotene 1·8-5·2 mg. %, sugar 5·5-12·9%, acidity as malic 0·9-1·5%. Corresponding values for a single sample of wild fruit of *R. aureum* were 18·0, 21·1, 0·6, 12·0, and 1·1%.

384. Gorškov, I. S. 1940. (From the work of the Central Breeding and Genetics Laboratory of I. V. Michurin.) *Jarovizacija* No. 3 (30), pp. 152-6. (Condensed from *Plant Breed. Abstr.*, **11,** pp. 225-6.)
A currant × gooseberry hybrid was obtained by the intermediary method, crossing a hybrid currant with a gooseberry; it is spineless and bears its berries in clusters, these being dark red and intermediate in form.

Gravatt, G. F. 1917. *See* **Spaulding, P.,** and **Gravatt, G. F.**

385. Gray, E. G. 1949. An interesting disease of gooseberries. *Gdnrs' Chron.*, **125,** p. 198.
Describes a gooseberry disease similar to black currant reversion, but graft transmissible to gooseberry, although not to black currant.

386. Greenslade, R. M. 1941. The black currant leaf midge (*Dasyneura tetensi* (Rübs.).) *Rep. E. Malling Res. Sta. for 1940*, pp. 66-71.
The symptoms, life history and control of this pest are described. The midge does not infest red currants and other species of *Ribes*. Of eight varieties of black currant in a replicated trial, Goliath was most severely attacked and Davison's Eight and Boskoop Giant least. Wellington X, XX, and XXX, Baldwin, and Seabrook's Black all showed moderate susceptibility. In a second trial Boskoop Giant was again the least attacked while Seedling HT4 (Emsden's Defiance selfed) was worst; Baldwin and HT7 (Boskoop × Baldwin × Boskoop), though considerably worse than Boskoop Giant, were markedly less severely attacked than HT4. Seedlings HT3, 5, and 6 showed an intermediate attack.

387. Gregory, C. T. 1925. Disease resistant fruits and vegetables. *Hoosier Horticulture*, 7 (3), pp. 35-9. (Condensed from *Rev. appl. Mycol.*, **4,** p. 362.)
The Columbian, Herbert, Donboro, and possibly St. Regis raspberries are resistant to leaf roll and mosaic, and Plum Farmer to anthracnose (*Plectodiscella* [*Elsinoë*] *veneta*).

388. Griffith, J. P. 1925. The Queensland raspberry, *Rubus probus*, a species adapted to tropical conditions. *J. Hered.*, **16,** pp. 328-34, and *J. Dep. Agric. Porto Rico*, **9,** pp. 29-45.
The Queensland raspberry was bred by James Pink, Brisbane, from the cross of the Japanese species *Rubus ellipticus* ♀ × *R. rosaefolius* ♂, a wild Australian type. Grown in Porto Rico, *R. probus* reaches a height of 7-8 ft compared with 12-15 ft for *R. ellipticus* and 3 ft for *R. rosaefolius*;

the stems are large, coarse and glabrous with a few short straight spines, whereas the female parent has coarse stems with heavy red pubescence and long sharp curved spines. *R. rosaefolius* is a weak plant though more spiny than *R. probus*.

R. probus breeds true from seed, it also suckers freely and grows well from root cuttings. It appears immune to *Septoria rubi* and to *Gloeosporium* [*Elsinoë*] *venetum*. It is noteworthy that the blackberries and dewberries from the southern U.S. are also quite resistant.

Crosses have been made between *R. probus* ♀ and Cuthbert ♂ and *R.trivialis* ♂.

Grottodden, O. 1943. *See* **Knowles, D., Grottodden, O.,** and **Long, T. E.**

389. Grubb, N. H. 1922. Commercial raspberries and their classification. *J. Pomol.*, **3,** pp. 11-35.

Detailed descriptions of the following raspberry varieties are given: *Pubescent new canes:* Red Antwerp B, Lloyd George, Norwich Wonder, Paradise Berry, Park Lane, Red Cross, and Steele's Victoria. *Glabrous or glabrescent canes:* Black Antwerp A, Red Antwerp A, C, D, E, and F (Red Antwerp F = Black Antwerp B), Bath's Perfection (= the American variety Marlboro = Laxton's Abundance), Baumforth's Seedlings A, B, C, Improved Beehive, Canadian Red, Carter's Prolific, Devon, Fastolf A, Fillbasket A, Goliath, Helston, Hornet A and B, Kirriemuir Fillbasket, Laxton's Bountiful, Mitchell's Seedling, Northumberland Fillbasket, North Ward, Prior's Prolific, Bunyard's Profusion, Pyne's Royal, Reader's Perfection, Red Magnum Bonum, Semper Fidelis, and Superlative.

390. Grubb, N. H., and **Peren, G. S. 1922.** A note on the impurity of raspberry stocks. *J. Pomol.*, **3,** pp. 7-10.

391. Grubb, N. H. 1924. Raspberry investigations. *Rep. E. Malling Res. Sta. for 1923*, pp. 128-30.

It is considered that Baumforth's Seedling B is the original Northumberland Fillbasket, and that Fillbasket A is correctly Fastolf (syn. Filby Seedling). Of ten varieties, Pyne's Royal for the fourth year in succession gave the highest yield.

392. Grubb, N. H., and **Massee, A. M. 1924.** Raspberry 'mosaic'. *Rep. E. Malling Res. Sta. for 1923*, pp. 131-3.

The mosaic common in Britain is believed to be distinct from that in America; specific symptom differences are enumerated. European varieties have usually proved resistant in America, while the only American variety examined by the authors, Marlboro (Bath's Perfection), was more resistant than local varieties. Finally, *Aphis rubiphila*, the vector in America, has not been recorded in England.

Grubb, N. H. 1925. *See* **Hatton, R. G., Grubb, N. H.,** and **Knight, R. C.**

393. Grubb, N. H. 1925. Raspberry varieties and their cropping. *Rep. E. Malling Res. Sta. for 1924*, pp. 75-80, and *J. Pomol.*, **5,** pp. 131-6.

Records the results from unreplicated raspberry plots at East Malling from 1919 onwards.

In 1925, Baumforth A, Mitchell's Seedling, Prior's Prolific, and Red Antwerp A all suffered from blue stripe wilt or 'die back'; Baumforth B suffered badly from anthracnose.

The three earliest varieties were Mitchell's Seedling (=Semper Fidelis B), Prior's Prolific, and Norwich Wonder. The latest of all varieties proved to be Hornet E (=Improved Hornet or Late Hornet); next to this in lateness comes Devon.

394. Grubb, N. H. 1931. The heaviest cropping raspberry varieties at East Malling. *Rep. E. Malling Res. Sta. for 1930, General*, pp. 52-4.

Out of 20 varieties in the trial the following seven (arranged in descending order) yielded best: Baumforth A, Helston, Lloyd George, Red Antwerp C, North Ward, Red Cross, and Pyne's Royal. Descriptive notes are given of these varieties.

395. Grubb, N. H. 1931. The cropping of raspberry varieties at East Malling. *Rep. E. Malling Res. Sta. for 1928-30, Suppl.*, pp. 32-45.

The yields of fifteen varieties of raspberry are given from a replicated trial for 1927-30. The heaviest cropper, Baumforth A, is suitable only for cooking and jam. The second, Helston, often produced fruit too small and too poorly coloured to be profitable. Lloyd George and Red Antwerp C yielded only a fraction less than Baumforth A. Royal came seventh but, on account of its large fruit, is often worth more than varieties of heavier yield.

Notes on individual varieties indicate their suitability for certain purposes, their soil preferences and other points of interest.

Grubb, N. H. 1933. *See* **Harris, R. V.,** and **Grubb, N. H.**

396. Grubb, N. H. 1935. Raspberry breeding at East Malling 1922-34. *J. Pomol.*, **13,** pp. 108-34.

The characters of a good commercial raspberry include large, smooth, 'compact' (i.e. not crumbly) fruit easily plugged and firm enough to travel in 4 lb. chips. Quality should be at least passable for dessert. Good yield is essential but the plant must not smother the fruiting canes by dense growth. Disease and frost resistance, erectness and reasonable freedom from spines are important. Sources of these qualities are:

Large fruit: Pyne's Royal, Lloyd George, Preussen, Red Cross.

Smooth outline: Burnetholm, Red Cross, Lloyd George.

Compactness and easy plugging: Most varieties.

Firmness: Penwill's Champion, Baumforth B, Pyne's Royal, Burnetholm.

Bright colour: Preussen, Bath's Perfection, several American varieties.

Not turning dark: Burnetholm, North Ward, Preussen, Mitchell's Seedling, Norfolk Giant.

Dessert quality: Norwich Wonder A, Preussen, Baumforth B, Hornet A.

Soft fruit (for jam): Baumforth A, Hornet A.

Consistent heavy cropping: Lloyd George, Baumforth A, Norfolk Giant.

Vigour: Norfolk Giant, Baumforth A, Preussen.

Erect habit: Preussen, Pyne's Royal, Bath's Perfection.

Disease resistance: MacLaren's Prolific, Baumforth A, and perhaps Pyne's Royal and Red Cross.

Hardiness: Lloyd George (in Scotland), Improved Beehive, several American varieties.

Details are given of selfed progenies of a number of commercial varieties. In general selfed seedlings more often exaggerated the faults than the merits of the parents.

Selfing Pyne's Royal gave outstanding average fruit size but colour was in general poor, many were crumbly and many seedlings were impossible to plug. Disagreeable flavour was strongly inherited in one F_3 family.

In no case was Lloyd George, or any of its selfed seedlings, difficult to plug. Most seedlings produced far too many canes and crumbly fruit was common.

Out of a family of 71 obtained by selfing Red Cross, 33 were either yellow fruited or sterile.

North Ward selfed gave 91 plants of which 17 were chlorophyll deficient and most of the remainder had small crumbly fruit. The pale fruit colour reappeared in very many of the seedlings and hardly any turned seriously dark when fully ripe.

Selfs of Preussen lacked vigour and usually had small and very crumbly fruit.

Selfs of Semper Fidelis A, like the parent, all proved very susceptible to cane spot. The acid fruit of the parent was inherited by most of the family.

Baumforth A selfed consisted mainly of forms very similar to the parent, particularly in fruit characters.

Norwich Wonder A selfed was exceptionally variable in every character. Of the 143 plants, 56 were either yellow fruited or sterile.

The hybrid family, Pyne's Royal · Lloyd George, gave nearly 25% 'yellows' and 'apricots'. Two other families, made by intercrossing selfed seedlings of these two varieties, showed a clear gain as compared with straight crossing in one case and a slight gain in the other.

Pyne's Royal × Winkler's Seedling gave 12 red: 6 yellow or apricot, and the hybrid family was more readily infected with mosaic than any other family.

Preussen × Lloyd George gave over 20% 'yellows' and 'apricots'.

One family gave an incomplete correlation between tinged spines and fruit not turning dark versus red spines and dark fruit.

The work of Crane and Lawrence (1931) on spine and fruit colour is supported, but it is pointed out that some green-spined forms have a fruit colour intermediate between apricot and red. Furthermore, red-spined plants can have pale red fruit, and tinged-spined plants sometimes have dark fruit. The presence of two linked colour factors other than P is suggested.

Where there was segregation for green spines in selfing there was nearly always a deficiency of green. The largest were in Baumforth A (77 tinged: 3 green) and Pyne's Royal (74 red: 4 green) against expectations of 60: 20 and 58·5: 19·5 respectively. Winkler's Seedling selfed gave 12 red: 9 green, and the cross Pyne's Royal × Winkler's gave 12: 6.

The genotypes of eight commercial varieties are given: Semper Fidelis A PPTT; Hornet A PpTT; Mitchell's Seedling PpTt, Baumforth A, Red Cross, North Ward, Preussen and MacLaren's Prolific ppTt.

Two types of chlorophyll deficiency are recognized—a severe form and a partial or long-lived form. The latter occurs much more commonly with green spines than with red.

The following varieties give a proportion of female sterile plants on

selfing: Baumforth B, Black Antwerp A, Hornet A, Mitchell's Seedling, Norwich Wonder A (—Fillbasket A, Storrie's Invincible), Red Cross, Superlative A, Winkler's Seedling.

The work of Crane and Lawrence on the inheritance of hairiness is confirmed.

Northumberland Fillbasket Thornless selfed gave plants which, like their parent, had only very few spines. Burnetholm selfed gave a 3: 1 ratio of spined to entirely spineless. In the same family, out of 20 plants, 3, all yellow fruited, had sepaloid flowers.

397. Grubb, N. H. 1942. Raspberry planting: some notes on varieties. *Rep. E. Malling Res. Sta. for 1941*, pp. 52-3.

Notes are provided on Lloyd George, Norfolk Giant (a late variety: probably more planted than any other type), Brocket Hall, Pyne's Royal and Pyne's Imperial (large fruit but produces too few canes), Red Cross (rather spreading and thorny), Laxton's Bountiful, Matchless, Preussen (large good-flavoured fruit which tends to be soft), Newburgh (extremely susceptible to *Leptosphaeria coniothyrium*), Hercules (does not always produce enough cane), St. Walfried, and Doncaster.

398. Grubb, N. H. 1943. Five new raspberry seedlings. *Rep. E. Malling Res. Sta. for 1942*, pp. 31-3.

Describes seedlings E 33/132, G 32/166, J 33/54, K 33/115 and L 34/42. In some soils E [Enterprise] does not always produce enough cane; its fruit is the largest of the five and the dessert quality good. The fruit of J [Jewel] is large and firm enough for all purposes; the dessert quality is fair to good. L [Landmark] has large light bright-red fruits but the flesh is apt to be too soft except for jam. Seedlings E, G, J, and K are highly tolerant of mosaic 2. E is susceptible to cane blight and slighter attacks have been seen in G and J; K and L seem more resistant.

399. Grubb, N. H., and **Harris, R. V. 1945.** The planting and maintenance of raspberry cane nurseries. *Gdnrs' Chron.*, **117,** pp. 27, 33-4.

400. Grubb, N. H. 1946. Malling Promise raspberry. *Rep. E. Malling Res. Sta. for 1945*, p. 133.

Two selfs from Pyne's Royal and Lloyd George respectively, were crossed and an F_2 selection from this was crossed with Newburgh to give Family 51. Promise is a single plant selection in Family 51; it is highly resistant to natural infection with mosaic and is tolerant to mosaic 2.

401. Grubb, N. H., and **Harris, R. V. 1947.** New raspberry—Malling Notable. *Gdnrs' Chron.*, **122,** p. 220; *Grower*, **28,** p. 757; *Fruit-grower*, **104,** p. 744.

402. Grubb, N. H. 1948. Raspberries for the amateur's garden. *Fruit Yearb.*, roy. hort. Soc., Lond., pp. 100-8.

403. Grubb, N. H. 1950. Two new raspberry varieties. *Rep. E. Malling Res. Sta. for 1949*, p. 75.

Deals with Malling Jewel and Malling Exploit. Jewel is derived from Preussen × Seedling 23/50, the same parents as Enterprise; Exploit comes from Newburgh × Seedling 30/8, the same derivation as Promise. Jewel, previously Seedling J, is a second early, ripening after Lloyd George and

Promise but before Newburgh; Exploit, previously Seedling X, is early, ripening with or just after Lloyd George and Promise.

404. Grubb, N. H. 1950. Raspberry varieties up-to-date. *Grower*, **34,** pp. 79-82.

405. Grubb, N. H., and Wood, C. A. 1954. Recent progress in raspberry breeding. *Rep. E. Malling Res. Sta. for 1953*, pp. 95-104.

Yield data from four varietal trials are presented.

Data are given on the origin of the Malling seedling varieties in the trials and the characteristics of breeding families and of individual selections are discussed. A genealogical tree is provided covering the families from which the main selections in the breeding plots at East Malling have originated.

406. Gruber, F. 1932. (Berry fruit breeding.) *Züchter*, **4,** pp. 237-42.

407. Gruber, F. 1934. (Studies in variation statistics of some economically important characters in small bush fruits. Preliminary communication.) *Züchter*, **6,** pp. 294-6.

Currants show considerable varietal variation in fruit size; Houghton Castle, Fay New Red, White Versailles, Red Versailles, and Long Clustered White have outstandingly large fruits. Raceme length is usually correlated with number of flowers, and neither is correlated with fruit size.

Second and third generation crosses between American and European gooseberries contained a large proportion of small-fruited seedlings; fruit size is multifactorial, necessitating repeated backcrossing to the large-fruited varieties.

408. Gruber, F. 1934. (The breeding of small fruits.) *Naturwissenschaften*, **22,** pp. 819-21. (Condensed from *Plant Breed. Abstr.*, **6,** p. 313.)

Material from large numbers of American species of gooseberry crossed with European types is expected to give forms resistant to *Sphaerotheca mors-uvae*. The hybrid *Ribes succirubrum* × *R. grossularia* combines vigour, fertility and desirable flavour with some mildew resistance.

F_2s of Lucretia (*Rubus flagellaris* var. *roribaccus*) × Norwegian (probably *idaeus*) have been backcrossed to the red parent. Crosses have been made between American and European true raspberries to utilize the winter hardiness of the former.

409. Gustafsson, Å. 1930. (Emasculation and pseudogamy in *Rubus*.) *Bot. Notiser*, pp. 477-94.

410. Gustafsson, Å. 1933. (The history of the origin of *Rubus bellardii* Whe. and N.) *Bot. Notiser*, pp. 231-47. (Condensed from *Plant Breed. Abstr.*, **4,** p. 85.)

Rubus bellardii, a well defined species with few variants or hybrids, is pentaploid ($2n=35$): all other *Rubi Eubati* are tetraploid [cf. Gustafsson, 1938]. Five chromosomes with satellites were present, three being identical and distinct from the other two. The reduction division was typical of a pentaploid hybrid; gemini and polyvalents were common though complexes with more than five were never seen. Secondary chromosome association, involving a maximum of five, was frequent. The percentage of morphologically good pollen was 50-60.

This central and southern European species has probably arisen comparatively recently by hybridization involving two partially unreduced gametes. Its high chromosome number, marked resistance to cold and wind, and its general vigour account for its present extensive area. Though apomictic, the species is still capable of functioning as a pollen parent.

411. Gustafsson, Å. 1933. (Chromosome numbers in the genus *Rubus*.) *Hereditas, Lund*, **18,** pp. 77-80. (From *Plant Breed. Abstr.*, **4,** pp. 85-6.)

In connexion with facultative apomixis, in which the European forms differ from the American, it is pointed out that no wild triploids have been found in Europe, evidently owing to the infrequency of crossing between sexual diploids and the apomictic tetraploids, or the production, when such a cross occurs, of unreduced egg cells, giving rise to forms with a higher selection value.

The species studied are grouped into $2x$, $4x$, $5x$, $6x$, $7x$, and aneuploid forms. Of the latter, only one occurred, *R. eluxatus* Neum. var. *subnitidus* Lidf. $2n=45$ and this conclusion was based on the examination of only one plate. The basic number 7 was confirmed.

412. Gustafsson, Å. 1938. Species formation and polyploidy within the apomictic genera *Rubus* and *Taraxacum*. *Genetics*, **23,** pp. 149-50 (Abstr.). (From *Plant Breed. Abstr.*, **8,** p. 286.)

None of the American *Rubi Eubati* are apomictic [cf. Einset, 1951]. The thousands of European microspecies belong to two different groups, the *Rubi Eubati veri* and the *Rubi Corylifolii*, and only two sexual diploid species are known. All more or less apomictic *E. veri* are $3x$, $4x$, and $5x$ ($x=7$). *Rubi Corylifolii* are hybrids between *E. veri* and the tetraploid apomict *R. caesius*; their chromosome numbers are 28, 35, 42, and 49. The occurrence of panmixis makes the taxonomy of the European *Rubi* arbitrary and superficial.

413. Gustafsson, Å. 1939. Differential polyploidy within the blackberries. *Hereditas, Lund*, **25,** pp. 33-47.

This study of the incidence of polyploidy among wild European and American *Rubus* species of the groups *Eubati veri* and *Rubi Corylifolii* includes chromosome numbers of many Scandinavian forms. European *Eubati veri* are $3x$, $4x$, or $5x$, but never $6x$ or $7x$. Of the apomictic microspecies 82% are tetraploid. American *Eubati veri* (sexual) are $2x$, $3x$, $5x$, $6x$, and $8x$.

Rubus idaeus × *R. caesius* easily forms unreduced gametes so that the F_1 and backcrosses show $3x$, $4x$, $5x$, and $6x$ numbers. *R. caesius* is capable of forming unreduced gametes as male parent in the cross with *idaeus*, although it is apparently always tetraploid itself.

East Scandinavian *Rubi Corylifolii* are mostly tetraploid. West Scandinavian *Rubi Corylifolii* are $4x$, $5x$, $6x$, super-hexaploid, or $7x$, and several eastern *Corylifolii* show higher chromosome numbers in the western region. Several western *Corylifolii* contain different chromosome races. The differential polyploidy in the *Corylifolii* is probably due to an increase of the chromosome number in crosses between *R. caesius* and Atlantic *Eubati veri* or to crosses between Atlantic *Corylifolii* (themselves derived from crosses between *R. caesius* and *Eubati veri*) and to *status quo* in crosses between *caesius* and eastern *Eubati veri* or between eastern *Corylifolii*.

414. Gustafsson, Å. 1942. The origin and properties of the European blackberry flora. *Hereditas, Lund*, **28**, pp. 249-77.

The European blackberries are divided into two great complexes: the *Moriferi* (*Eubati*) *veri* and the *Corylifolii*. The *Corylifolii* are related to *R. caesius*, being primary and secondary cross products of *Moriferi veri* and *R. caesius*.

The European *Rubi Sub-erecti* are closely allied to N. American blackberries, especially to the species *R. villosus*, *R. allegheniensis*, and *R. canadensis*. Among the European *Suberecti* no sexuals have been found and all appear to be $4x$ or $3x$, whereas N. American *Moriferi veri* are sexual (*R. vitifolius*(=*R. ursinus*) from western America belongs to another section).

If the European blackberries once arose from diploid sexuals, these should be relatives of species resembling the presumed primary species *R. tomentosus*, *R. ulmifolius* (=*rusticanus*), *R. incanescens*, *R. bollei*, and *R. caucasicus*.

The recessive nature of apomixis in *Rubus* affords an enormous potential source of new variants. Except for a small number of triploids and pentaploids, all apomicts occurring in nature are $4x$, possibly with some monosomics or trisomics arising infrequently. The great mass of European *Moriferi veri* have 28 somatic chromosomes.

R. nitidus behaves as an autotriploid. *R. thyrsoides* Wimm. is assigned to a collective group which includes *R. thyrsanthus*, *R. candicans*, *R. elatior*, and *R. phyllostachys*. The first three are autotriploid.

R. bellardii appears to occupy a position between auto- and allopolyploidy cytologically.

No diploid *Corylifolii* are known, and most of them are $4x$, $5x$, or $6x$, $4x$ types predominating.

Meiosis is discussed in a number of species. *R. tomentosus* shows 7 bivalents at diakinesis and first metaphase. *R. nitidus* ($3x$) gives an average of 4 trivalents per cell and from 1 to 6 univalents are seen. The five tetraploid *Moriferi veri*, *R. polyanthemis*, *R. affinis*, *R. vestitus*, *R. armeniacus*, and *R. hirtus*, averaged 0·86, 0·67, 0·67, 1·00 and 0·06 quadrivalents per cell respectively.

Two cells of *R. bellardii* gave $1_v+13_{ii}+4_i$ and $1_v+1_{iv}+12_{ii}+2_i$ (or possibly $1_v+2_{iv}+10_{ii}+2_i$) and there are three satellited chromosomes.

R. vestervicensis shows a rather high frequency of multivalents and appears to be more autopolyploid than *R. bellardii*.

Studies of meiosis in *R. caesius* suggest that this species is allotetraploid.

Like the tetraploid *Moriferi veri*, *Rubi Corylifolii* have a rather low frequency of multivalents, but univalents are also common. Six P.M.C.'s of *R. rosanthus* var. *lejocarpus* gave an average of $1·83_{ii}$ per cell and 21 first metaphases averaged $2·86_i$ per cell. *R. bahusiensis* gave $1·95_i$ per cell. *R. centroformis* v. *Lidforssii* averaged $1·00_i$ per cell at metaphase I. Thus in these three *Corylifolii* a weak autopolyploidy bordering on allopolyploidy prevails.

R. wahlbergii and *R. pruinosus* ($5x$) approach cytologically an autopolyploid constitution.

Thus triploid blackberries behave as strict autopolyploids. Tetraploid *Moriferi veri* behave as weak auto- or even as allo-polyploids. *R. caesius* is a more or less strict allopolyploid. Tetraploid *Corylifolii* resemble the corresponding *Moriferi veri* in meiotic behaviour but the univalent frequency is higher. Pentaploid *Moriferi* show rather high multivalent formation but are not strict autopolyploids. Pentaploid *Corylifolii* behave

more or less as autopolyploids although in origin they are genetically allopolyploid. The autopolyploid state of *R. wahlbergii* implies a restriction on the value of meiosis in proving genetic auto- or allo-polyploidy.

The mechanism of the pseudogamy occurring in *Rubus* is not completely known. The unreduced gametophyte is formed by apospory (rarely by diplospory?) and the egg cell develops without external stimulus autonomously. The difference between autonomous apomixis and pseudogamy is simply the necessity of fertilizing (or less probably stimulating) the fused polar nuclei in the latter case. The *Moriferi veri* have developed a special system of equilibrium characterized by two features, the disappearance of apomixis in hybridization and its recovery by segregation. Thus the individual biotypes acquire a faculty of variation but at the same time maintain their quality of constancy.

415. Gustafsson, Å. 1943. The genesis of the European blackberry flora. *Acta Univ. Lund*, **54,** 199 pp. (Condensed from *Plant Breed. Abstr.*, **17,** p. 336.)

A comprehensive survey is given of the natural variation and putative origin of the European blackberries.

After a short historical introduction, the morphology and taxonomy of the blackberries are treated, and these sections are followed by descriptions of the blackberry floras of a number of European countries and of the Azores and the Canary Islands.

The role of pseudogamy and apomixis, hybridization, autosegregation and bud mutation is then elucidated, also the significance of chromosomal constitution, meiotic aberrations and polyploidy.

It is considered that in the Pliocene era there were a group of diploid species, represented today by such forms as *Rubus bollei*, *R. ulmifolius*, *R. tomentosus*, *R. incanescens*, *R. moschus* and possibly *R. alnicola*. Many others probably existed but have since become extinct or so rare that they have not yet been discovered. The present wide range of polyploid forms probably arose from hybridization between the original diploids accompanied by polyploidy and apomixis. The variation within the present-day polyploids greatly exceeds that found in the diploids.

416. Gustafsson, C. E. 1935. *Rubus kollundicola* C. E. Gust. *Svensk bot. Tidskr.*, **29,** pp. 407-9. (From *Plant Breed. Abstr.*, **6,** p. 193.)

The Latin diagnosis of the type form of *R. kollundicola* C. E. Gust. n.sp. with a note on its discovery. Its chromosome number, $2n = 35$, indicates hybrid origin; one parent may be a *pyramidalis* form. A new variety *scabior* C. E. Gust. is also given a Latin diagnosis.

417. Hahn, G. G. 1928. The inoculation of Pacific northwestern *Ribes* with *Cronartium ribicola* and *C. occidentale*. *J. agric. Res.*, **37,** pp. 663-83.

Practically all northwestern *Ribes* species proved decidedly susceptible to *C. ribicola*. *R. triste* was immune to *C. occidentale* and susceptible to *C. ribicola*, though less susceptible than many other species.

418. Hahn, G. G. 1929. Preliminary report on a variety of red currant resistant to Weymouth pine rust. *Proc. bot. Soc. Edinb.*, **30,** pp. 137-46. (Condensed from *Exp. Sta. Rec.*, **64,** p. 745.)

The author gives information regarding *Ribes* spp. and their history, relations and behaviour in Europe, Great Britain and America, with an

account of the resistance to white pine blister rust of the Norwegian Red Dutch variety of currant.

419. Hahn, G. G. 1930. A physiological method of distinguishing *Cronartium ribicola* and *C. occidentale* in the uredinial stages. *J. agric. Res.*, **40,** pp. 105-20. (Condensed from *Rev. appl. Mycol.*, **9,** pp. 569-70.)

In greenhouse experiments a number of species and varieties of *Ribes* were inoculated with *Cronartium ribicola* and with *C. occidentale*. Most red and white currants proved susceptible to *C. ribicola* and immune from *C. occidentale*; Fay's Prolific proved the most adaptable and dependable differential host. Three varieties, Franco-German, Holland, and Victoria, were found immune from both rusts, but this finding would need confirmation by further tests under varying conditions.

C. occidentale produced scant infection on black currant, although this is the most susceptible uredo host of *C. ribicola*. Champion was the most susceptible black currant to *C. occidentale* while Blacksmith and Boskoop Giant were immune. Of twelve foreign species of *Ribes* tested, *R. tenue* and *R. fasciculatum* alone proved to be susceptible to *C. ribicola* and immune from *C. occidentale*. *R. aureum* is susceptible to both rusts.

420. Hahn, G. G. 1935. Immunity of Viking, a Norwegian red currant, to *Cronartium ribicola* and *C. occidentale* under greenhouse conditions. *Circ. U.S. Dep. Agric.*, **330,** 16 pp. (Condensed from *Plant Breed. Abstr.*, **5,** p. 363.)

The history and botanical description of Viking (*Ribes petraeum* group) is given. This Norwegian currant is distinct from the Red Dutch currant, though the two forms originally possessed the same varietal name. Greenhouse experiments from 1929 to 1932 showed Viking to be consistently immune to *Cronartium ribicola* strains as far as the production of fertile or abortive uredinia or telia was concerned. Necrotic flecks did form in expanded leaves that were tender and unhardened, but fully mature leaves showed no sign of infection. Field tests begun in 1932 confirmed the results of greenhouse experiments. Similar immunity to aeciospores of *C. occidentale* was revealed by inoculation tests in 1931.

421. Hahn, G. G. 1936. Immunity of Viking red currant from white pine blister rust under field conditions. *Phytopathology*, **26,** pp. 860-75. (Condensed from *Exp. Sta. Rec.*, **77,** p. 650.)

The near immunity of Viking to eastern and western strains of *Cronartium ribicola* was shown for 973 bushes exposed for three years in 28 plats distributed through blister rust areas in New England, New York, Oregon, and Ontario. Artificial inoculations of test plants failed, though the atmospheric conditions were favourable. Viking thus shows high resistance to British and American strains of the rust. Resistance is dominant.

422. Hahn, G. G. 1938. Blister rust susceptibility studies of naturally pollinated seedlings of the immune Viking currant. *J. For.*, **36,** pp. 737-47. (Condensed from *Plant Breed. Abstr.*, **9,** p. 118 and **10,** p. 55.)

The Viking red currant (syn. Rød Hollandsk Druerips) is a Norwegian variety immune to *Cronartium ribicola* Fischer. It is probably closely related to, or may be identical with, the immune variety Rote Holländische of Tubeuf. The possibility of obtaining immune seedlings was

tested by growing seed isolated from other varieties and seed from plants which had been exposed to cross pollination. The seedlings (1,835) were artificially inoculated and only 3·7% of them proved susceptible. It is believed that these seedlings were all the result of selfing or crossing between different Viking bushes. The susceptible seedlings were, with two exceptions, greatly lacking in vigour even before infection.

423. Hahn, G. G. 1939. Susceptibility of seedlings of *Ribes punctatum*, the Andine currant, to *Cronartium ribicola*. *Phytopathology*, **29,** pp. 643-4.
Little is known as to the susceptibility of South American species of *Ribes* to *C. ribicola*, and the susceptibility of *R. punctatum* is here reported for the first time.

424. Hahn, G. G. 1939. Immunity of a staminate clone of *Ribes alpinum* from *Cronartium ribicola*. *Phytopathology*, **29,** pp. 981-6.
The dioecious ornamental mountain currant has been reported both as immune and as susceptible to *C. ribicola*. The reactions of a male clone and of a female clone were separately tested: the former proved immune and the latter susceptible. This confirms work by Clinton and McCormick who discovered, but did not emphasize, a difference in rust susceptibility between the two sexes of this species.

425. Hahn, G. G. 1941. Field tests with a staminate clone of alpine currant immune from blister rust under greenhouse conditions. *Plant Dis. Reptr*, **25,** pp. 476-8. (Condensed from *Plant Breed. Abstr.*, **12,** p. 278.)
Infection experiments confirmed greenhouse tests demonstrating the susceptibility to *Cronartium ribicola* of the pistillate plants in the experimental material; the staminate plants remained immune.

426. Hahn, G. G. 1943. Blister rust relations of cultivated species of red currants. *Phytopathology*, **33,** pp. 341-53.
Most commercial varieties of red currant derive from *Ribes sativum* and are very susceptible to *Cronartium ribicola*. Red Dutch (a European variety distinct from the English and American Red Dutch) and Viking, both probably deriving from *R. petraeum*, are immune whilst varieties of *R. rubrum* origin are moderately to highly resistant.

427. Hahn, G. G. 1948. Immunity of Canadian black currant selections from blister rust. *Phytopathology*, **38,** pp. 453-6.
Two selections from crosses between *Ribes ussuriense* and *R. nigrum* (Kerry) proved immune to *Cronartium ribicola*.

428. Hahn, G. G. 1949. Evidence of the non-existence of physiological races in *Cronartium ribicola*. *Phytopathology*, **39,** pp. 85-7.
From the behaviour of Viking red currant in North America and Europe, it seems unlikely that physiological races of *Cronartium ribicola* exist.

429. Hahn, G. G., and **Miller, A. 1949.** Rust immunity of Canadian black currants under field conditions in Connecticut. *Plant Dis. Reptr*, **36,** pp. 275-6. (Condensed from *Rev. appl. Mycol.*, **28,** p. 631.)
Further tests with the Canadian black currant hybrid selections, Crusader

and Coronet, immune from *Cronartium ribicola* were carried out under field conditions. One potted plant of each variety and two rust-susceptible *Ribes cynosbati* plants were transplanted into a field close to cankered *Pinus strobus*. In May, the hybrids were dusted with aecidiospores; they remained completely free from infection though the control plants and wild *Ribes* in the area were heavily rusted and practically defoliated by the end of the summer.

430. Hall, E. H. 1946. Fruits and nuts. *Prog. Rep. Domin. exp. Sta. Saanichton, B.C., 1937-1946*, pp. 4-15.
All *Rubus* plants examined have proved susceptible to dryberry (*Hapalosphaeria deformans*).

A hybrid known as the Worcester berry (Boskoop × Whinham's Industry) which has been grown for several years, resembles Whinham's Industry in its spininess and in its rather medium-sized gooseberry-like fruit. The fruit is pleasant and of good quality but the plant is so spiny that picking is difficult.

431. Hall, J. W. 1955. Scottish fruit trials. First progress report. *Scot. Agric.*, **34**, pp. 222-4.
Initial fruiting laterals of Lloyd George were damaged by nine degrees of frost at Liberton, but secondary laterals were produced to replace them. Dates of picking are given for a range of raspberry varieties for two seasons.

In black currant trials, Baldwin and Wellington XXX were consistently amongst the earliest to flower while Amos Black was usually last. Season of ripening is given for a range of varieties: Boskoop Giant, Laxton's Giant, and Laxton's Grape were usually the first to be picked at all stations and Daniel's September was generally the last.

Westwick Choice, Laxton's Grape, Amos Black, Baldwin, and Silvergeiter's Black were severely affected by leaf spot; Boskoop Giant and Mendip Cross were least affected.

Silvergeiter's Black, Seabrook's Black, and Boskoop Giant have received the best reports for canning, and Laxton's Giant, Boskoop Giant, and Seabrook's Black are good for quick freezing.

432. Hamel, J. H. 1953. (Contribution to the cyto-taxonomy of the Saxifragaceae.) *Rev. Cytol., Paris*, **14**, pp. 113-313.
On the subject of *Ribes* it is considered that this genus forms a sharply defined homogeneous group on both morphological and cytological grounds, and that it should be classed at least as a sub-family of the *Saxifragaceae*.

433. Hamilton, A. 1949. The blackberry mite (*Aceria essigi*). *N.Z. J. Sci. Tech.*, **31**, pp. 42-5. (From *Plant Breed. Abstr.*, **21**, p. 419.)
Wild blackberries and the cultivated varieties Himalaya and Evergreen are susceptible to *A. essigi* in both U.S.A. and England. Susceptible wild blackberries are also found in New Zealand, but Evergreen appears resistant there.

Hammond, D. H. 1939. *See* **Garner, R. J.**, and **Hammond, D. H.**

Hansbrough, J. R. 1933. *See* **Mielke, J. L.**, and **Hansbrough, J. R.**

434. Hansen, N. E. 1906. Breeding hardy raspberries for the North-west. *Proc. Amer. Breed. Ass.*, **2,** pp. 128-9. (Condensed from *Exp. Sta. Rec.*, **18,** p. 940.)

Thd author points out the great need for hardy raspberries for the North-west prairie region and reports his results from 10 years' work. A large number of native raspberries were gathered from the Dakotas, Minnesota, Manitoba, and Assiniboia, together with varieties from three different continents. Of the many thousands of seedlings raised, one proved specially promising. This was named Sunbeam: it is a hybrid between Shaffer Colossal and a wild raspberry from N. Dakota and is said to withstand severe winters.

435. Hansen, N. E., and **Haralson, C. 1907.** Raspberries, blackberries and dewberries. *Bull. S. Dak. agric. Exp. Sta.*, **104,** pp. 268-97. (Condensed from *Exp. Sta. Rec.*, **19,** pp. 440-1.)

Illustrations are given of over 140 seedling varieties which have proved hardy without protection. The text of the previous paper (Hansen, 1906) is given and extracts are included from a report by F. L. Cook on the brambles in the Black Hills in which it is stated that blackberries, black cap raspberries and hybrid raspberries of the Columbian type are low yielding and unprofitable. Of a large number of red raspberries tested in the same region, Loudon and Marlboro are twice as productive as any others.

436. Hansen, N. E. 1924. New fruits. *Rep. S. Dak. agric. Exp. Sta.*, pp. 27-8.

This includes notes on the origin and characteristics of the Sunset gooseberry.

Haralson, C. 1907. *See* **Hansen, N. E.,** and **Haralson, C.**

Haralson, C. 1921. *See* **Dorsey, M. J.,** and **Haralson, C.**

437. Hardy, M. B. 1932. Self and cross fertility of red raspberry varieties. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 118-21.

Pollen was germinated in 10% glucose and the following percentage germinations were obtained: Cuthbert 7·5, King 35·0, Marlboro 19·5, Latham 15·0, Antwerp 72·0, and Lloyd George 52·3.

Only in one (Cuthbert × Latham) out of the many crosses was there any sign of even partial cross sterility. Other varieties were almost entirely cross- and self-fruitful and failures to set seed were usually due to faulty technique of pollination.

438. Hardy, M. B. 1932. Red raspberry pollination technique. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 122-4.

Emasculation was accomplished by cutting around the stem of the flower bud with a scalpel, the cut being made about half way between the stem and the largest circumference of the bud. Opaque manilla bags were used for covering emasculated buds. Pollination was done 2-5 days after emasculation and every day thereafter until the pistils began to turn brown.

439. Harris, R. V. 1925. The blue stripe wilt of the raspberry. *J. Pomol.*, **4,** pp. 221-9, and *Rep. E. Malling Res. Sta. for 1924*, pp. 126-33.

The following were among the varieties most severely attacked by *Verticillium*: Bath's Perfection, Red Antwerp B, Prior's Prolific, Mitchell's

Seedling, Red Antwerp A, Baumforth A and B, and Reader's Perfection. Black Antwerp A proved one of the least seriously attacked, but no variety was completely free from the disease.

440. Harris, R. V. 1926. Three raspberry diseases. *Rep. E. Malling Res. Sta. for 1925*, pp. 64-72.
Deals with blue stripe wilt, cane spot, and mosaic, detailing the symptoms of each. Baumforth B is very susceptible to cane spot, Bath's Perfection is very susceptible to blue stripe wilt and Superlative to mosaic.

441. Harris, R. V. 1928. The pathology of the raspberry. A summary of results of recent research at East Malling. *Rep. E. Malling Res. Sta. for 1926 and 1927, II. Suppl.*, pp. 128-34.
Deals with blue stripe wilt (*Verticillium dahliae*), cane spot (*Plectodiscella* [*Elsinoë*] *veneta*), mosaic, and spur blight (*Didymella applanata*). Certain raspberry varieties are very susceptible to blue stripe wilt in a range of localities, notably Bath's Perfection, Red Antwerp B, and Prior's Prolific. Baumforth B was the most susceptible of all varieties to cane spot, and Semper Fidelis, Reader's Perfection and Devon were all very susceptible. With regard to mosaic, varieties were found to differ considerably (*a*) in rapidity with which infection spread from plant to plant, (*b*) in intensity of leaf symptoms, and (*c*) in the degree of dwarfing and degeneration. Laxton's Abundance (=Bath's Perfection) has never shown a trace of mosaic. Several other strains of Bath's Perfection and varieties such as Prior's Prolific, Red Antwerp B, and Baumforth A occasionally show slight symptoms. Lloyd George was originally considered resistant, but now the disease has become more serious in this variety. The spread of mosaic through a plot of Baumforth B was not rapid, and normal stools planted in close proximity to diseased canes remained healthy for years. In the case of Red Cross, Norwich Wonder, and Hornet A, a stool free from leaf symptoms has never been observed.

Some varieties are more susceptible than others to spur blight; Reader's Perfection, Pyne's Royal, Superlative, and Hornet A are amongst the most susceptible.

442. Harris, R. V. 1928. Raspberry cane spot and its control. *Rep. E. Malling Res. Sta. for 1927, I. General*, pp. 57-63.
Baumforth B, Semper Fidelis, Reader's Perfection, and Devon are all markedly susceptible.

443. Harris, R. V. 1931. Notes on diseases of the raspberry, loganberry and blackberry in 1928-30. *Rep. E. Malling Res. Sta. for 1928-30, II. Suppl.*, pp. 133-9.
The following are classed as spring frost susceptible: Pyne's Royal, Lloyd George, Devon, Laxton's Abundance, Cut-leaved blackberry and Himalaya berry.

Verticillium wilt was severe on Bath's Perfection, Reader's Perfection, and St. Regis [Ranere], the last being too severely attacked to be grown successfully at E. Malling.

Baumforth B was severely attacked by *Plectodiscella* [*Elsinoë*] *veneta* and this increased its susceptibility to frost; where the cane spot was reduced by spraying, frost injury was negligible.

P. veneta and *Didymella applanata* caused much loss in loganberry crops in Kent.

444. Harris, R. V. 1931. Raspberry cane spot: its diagnosis and control. *J. Pomol.*, **9**, pp. 73-99.

The symptoms of cane spot are described on red raspberry and the organism is shown to be *Plectodiscella* [*Elsinoë*] *veneta* (Speg.) Burk., the cause of anthracnose of *Rubus* spp. in America. Control measures are given.

Varieties differ markedly in susceptibility and this relative susceptibility remains constant in varying localities and seasons. Baumforth B was outstandingly the most susceptible. Other varieties which are seriously susceptible are Semper Fidelis A, Reader's Perfection, Devon, Red Antwerp C and Baumforth A. Bath's Perfection and Pyne's Royal are very resistant. There is a wide range of slightly susceptible and of moderately susceptible varieties.

445. Harris, R. V. 1933. Mosaic disease of the raspberry in Great Britain. I. Symptoms and varietal susceptibility. *J. Pomol.*, **11**, pp. 237-55.

This paper includes a classification of varieties according to their relative susceptibility and infectivity based on field observations over 10 years.

*Apparent susceptibility**	*Apparent infectibility*†		
	Low	*Moderate*	*Undetermined*‡
Low	Red Antwerp B Baumforth A MacLaren's Prolific	North Ward Hornet D Red Antwerp C Baumforth B Reader's Perfection Semper Fidelis A	Red Cross Burnetholm Hornet E
Moderate	Helston Goliath	Lloyd George Devon	Hornet A Norwich Wonder A
High		Red Magnum Bonum ? Preussen	Superlative Norwich Market Mitchell's Seedling Scotch Victoria

* 'Apparent susceptibility', the relative rate of degeneration of infected stools.

† 'Apparent infectibility', the relative rate of increase in the proportion of mosaic infected stools.

‡ 'Undetermined' comprises varieties in which every stool was infected at the time of the first survey.

446. Harris, R. V. 1933. The infection of raspberry fruits by the cane-spot fungus. *Rep. E. Malling Res. Sta. for 1932*, pp. 86-9.

Baumforth B is particularly susceptible to deformation of the fruits by *Plectodiscella* [*Elsinoë*] *veneta*.

447. Harris, R. V., and **Grubb, N. H. 1933.** The commercial control of raspberry mosaic disease. *Rep. E. Malling Res. Sta. for 1932*, pp. 149-51.

Mosaic can be controlled by using 'cane nurseries' established solely as a source of supply of cane free from mosaic virus. Recommendations are given for the planting and maintenance of nurseries of Lloyd George.

448. Harris, R. V. 1935. Some observations on the raspberry disease situation in North America. *Rep. E. Malling Res. Sta. for 1934*, pp. 156-64.

The raspberry disease situation in Eastern Canada and the U.S.A., with special reference to virus diseases, is described and compared with that in the Canadian West and in Great Britain. In Eastern Canada and the U.S. *Elsinoë veneta* is not considered of economic significance on the red raspberry but is serious on black raspberries. Canes of certain varieties, such as Viking, commonly showed scattered pit-lesions which might increase susceptibility to winter injury. As in England, virus disease dominated the picture. Transfers of leaf curl virus from Cuthbert to Lloyd George and Baumforth B caused both varieties to succumb rapidly. Most black raspberries are highly susceptible to red-raspberry mosaic and to yellow mosaic, but seedlings have been bred showing promise of low infectibility to the mosaics. Lloyd George shows very low infectibility with American mosaics under Eastern American and Columbian conditions, although grafting showed it to be highly susceptible. In eastern and western Canada, the spread of mosaic native to Lloyd George and introduced in it from England is extremely slow, or does not take place, and its infectibility by the mosaics occurring in the native varieties is also very low or non-existent.

In the Canadian West the only fungus diseases of importance are dry-berry disease or 'anther and stigma blight' (*Hapalosphaeria deformans*) and cane blight (*Leptosphaeria coniothyrium*). The loganberry and Lloyd George are particularly susceptible to the former, Cuthbert is very resistant.

The concluding section of this paper deals with breeding mosaic resistant varieties. At Ottawa, seedling resistance is examined by grafting. Latham is highly resistant and Viking, though susceptible, has a fairly low infectibility. Newburgh appears to combine very low infectibility with moderately high susceptibility. Cuthbert is exclusively grown in one particular area; practically all the cane is mosaic infected yet no marked deterioration in vigour occurs. One 23-year-old plantation of Cuthbert was still producing large crops.

449. Harris, R. V. 1936. Growing healthy raspberries. The control of diseases and pests. *Rep. E. Malling Res. Sta. for 1935*, pp. 232-42.

The final section of this paper deals with varieties in relation to diseases and pests. Cuthbert in America is outstandingly susceptible to both virus and winter injury. Relative susceptibility to blue stripe wilt, cane spot and spur blight appear only slightly dependent on locality, e.g. Baumforth B is highly susceptible to cane spot wherever it is grown. Red Cross has proved highly resistant to mosaic wherever it is grown commercially. For many years every stool of Red Cross has shown mosaic, but there has been no deterioration of vigour or yield and it remains among the best croppers at East Malling. Mitchell's Seedling resists the deteriorating action of mosaic for a number of years after all its cane is infected, but

when removed to another locality, rapidly succumbs and goes out of cropping.

450. Harris, R. V. 1940. Mosaic disease of the raspberry in Great Britain. II. Experiments in transmission and symptom analysis. *J. Pomol.*, **17**, pp. 318-42.
Mosaic 1 and mosaic 2 were successfully transmitted by grafting; all attempts at mechanical transmission failed. Mosaic 1 behaves as a single disease, is uniformly mild in expression and is of comparatively limited varietal distribution.

Mosaic 2 is widely distributed among local varieties and these show a wide range of susceptibility. Red Cross, though totally infected, is highly resistant; Lloyd George is a symptomless carrier. The severe economic form of mosaic in Lloyd George is due to joint infection by mosaic 1 and mosaic 2. Varieties susceptible to mosaic 2, such as Baumforth B and Mitchell's Seedling, rapidly become unproductive and die.

451. Harris, R. V., Beakbane, A. B., and **Moore, M. H. 1940.** A review of research on cane spot of loganberry and phenomenal berry. *Rep. E. Malling Res. Sta. for 1939*, pp. 68-9.
Research on commercial control of cane spot (*Elsinoë veneta*) of loganberry and Phenomenal berry from 1931 to 1939 is outlined. Loganberry is much more severely affected than Phenomenal.

Harris, R. V. 1945. *See* **Grubb, N. H.,** and **Harris, R. V.**

452. Harris, R. V. 1947. A review of some recent research on virus diseases of raspberry and strawberry in Great Britain. *Rep. E. Malling Res. Sta. for 1946*, pp. 133-7.
Baumforth B, Norfolk Giant, St. Walfried, and Lloyd George are used as differential indicators of raspberry viruses.

453. Harris, R. V., and **Cadman, C. H. 1949.** Can the health of raspberry stocks be improved? *Rep. E. Malling Res. Sta. for 1948*, pp. 138-40 and *Scot. Agric.*, **28**, pp. 194-7.
This paper summarizes the chief problems affecting raspberry growing and outlines a possible plan for the production and maintenance of continuous supplies of healthy planting stock. Information is given on the degeneration of varieties, notably Lloyd George, and on the virus status of stocks of certain varieties.

Harris, R. V. 1950. *See* **Prentice, I. W.,** and **Harris, R. V.**

Harris, R. V. 1951. *See* **Cadman, C. H.,** and **Harris, R. V.**

Harris, R. V. 1952a and b. *See* **Cadman, C. H.,** and **Harris, R. V.**

Hartman, H. 1943. *See* **Waldo, G. F., Wiegand, E. H.,** and **Hartman, H.**

454. Haskell, G. 1953. Quantitative variation in subsexual *Rubus*. *Heredity*, **7**, pp. 409-18.
Quantitative characters were studied in two pseudogamous subsexual families of Merton Early (*Rubus nitidioides*). One came from a single

self-pollinated plant (Family 32) and the other from several open-pollinated plants (Family 31). Family 32 suffered no inbreeding depression following 'selfing'.

Plant vigour histograms showed that Family 31, but not Family 32, might consist of several overlapping frequency distributions. Prickle frequency was normally distributed in Family 32 but Family 31 had no central peak, confirming that the former was a single segregating population while Family 31 comprised closely overlapping segregations.

First flowering times and fruit maturities were highly uniform and similar in both families but there was weak correlation for individual plants.

Variation ranges in both families were compared by plotting prickle numbers against flowering times. As both had similar distribution there was no evidence of genuine and widespread sexual reproduction. Variation, although detectable, was extremely limited, attributable to autosegregation rather than to true sexual segregation.

Prickle number might be reduced by selection; number of prickles, prickle size, and plant vigour were correlated.

455. Haskell, G. 1954. The history and genetics of the raspberry. *Discovery*, **15**, pp. 241-6.

The centre of origin of raspberries is believed to be eastern Asia. Some 200 forms have been described from parts of Asia alone. *Rubus idaeus* extends from 70° N. in Europe to 40° N. in Asia Minor. First mentioned in England in 1548 (Turner's Herbal) the raspberry really dates from much earlier times, its fruits having been identified in Swiss lake dwellings.

The American red raspberry, *R. strigosus*, was used by American Indians before Columbus. Forms with yellow and apricot fruits appear only among European varieties; American varieties with such characters are of hybrid origin. The American blackcap, *R. occidentalis*, segregates yellow fruited forms. Fruit colour in the red raspberry is controlled by cyanidins.

In contrast to blackberries and raspberry-blackberry hybrids, polyploidy has played little part in raspberry improvement. A brief survey of raspberry varieties and breeding is given and Lewis's work on polyploidy and autumn fruiting is reviewed.

456. Haskell, G. 1954. The genetic detection of natural crossing in blackberry. *Genetica*, **27**, pp. 162-72.

The pollination system in 4*x* blackberry was studied in a row of Merton Thornless plants situated between rows of thorny *Rubus*, using glandular v. eglandular cotyledons as markers. Average hybridization was 17%, ranging from 5 to 32% in different flower samples. End plants were 25% outcrossed and those within the row, 15%. Average first year germination was 45%, with a range from 18 to 66% in different fruit samples.

457. Haskell, G. 1955. Analysis of sexual-apomictic blackberry populations and their ecological consequences. *Cold Spring Harbour Symp. quant. Biol.*, **20**, pp. 111-26.

458. Haskell, G. 1955. Genic and environmental relations of flowering time in raspberry. *Genetica*, **27**, pp. 377-90.

High temperatures early in the year favour early flowering in *Rubus idaeus*. Daily amount of sunshine stimulates flowering with a lag of several days.

Homozygous sepaloid plants flower five days later than dominants, and yellow leaved homozygotes may flower up to nine days later than green leaved dominants. Recessives with yellow fruit and green spines may or may not be later, suggesting that this gene does not directly affect flowering time and that differences are due to a linked gene.

R. occidentalis × *R. idaeus* F_1s flowered earlier than either parent selfed. Similarly, F_1 families within *R. idaeus* show some of their heterosis by flowering earlier.

459. Hatton, R. G. 1920. Black currant varieties. A method of classification. *J. Pomol.*, **1**, pp. 65-80, 145-54.

Black currants are divided into four basic groups:

Red bud types

Group I represented by French Black (syn. Merveille de la Gironde), includes Ogden's Black, Black Grape, Lee's Prolific, Black Naples, North Holland Black, Seabrook's Black, Mammoth, Westwick, Resister, Siberian, and Dutch Black.

Group II represented by Boskoop Giant, includes Prince of Wales and Black Bunch (Schwarze Traube).

Whitish bud types

Group III represented by Goliath, includes Victoria, Edina, Monarch, Bang Up, and Coronation.

Group IV represented by Baldwin, includes Emsden Defiance, and Bodenburg's Black Prince (syn. Buddenborg).

Detailed descriptions are given of these groups.

460. Hatton, R. G. 1921. The 'running off' of black currants. *J. Pomol.*, **2**, pp. 160-98.

This paper is substantially the same as that by **Wellington, Hatton,** and **Amos, 1921.**

Hatton, R. G. 1921. *See* **Wellington, R., Hatton, R. G.,** and **Amos, J.**

461. Hatton, R. G., Grubb, N. H., and **Knight, R. C. 1925.** Black currant variety trials: Reliability of results. The variability in cropping of individual black currant bushes as a guide to the suitable size of experimental plots. *J. Pomol.*, **4**, pp. 200-20.

Individual bush records from plots of 60-70 bushes of 5 varieties of black currants show the probable error of the average crop of a variety to be approximately 2%. A tendency to biennial bearing was noted. The average crop figures for three years place the varieties in the following order: (1) Baldwin, (2) Goliath and Boskoop, (4) Seabrook's and French.

Hatton, R. G. 1927. *See* **Amos, J., Hatton, R. G., Knight, R. C.,** and **Massee, A. M.**

462. Hatton, R. G., and **Amos, J. 1927.** Some new and old varieties of black currant. *Rep. E. Malling Res. Sta. for 1926*, pp. 39-46.

A recapitulation of the classification given by Hatton (1920) with newer varieties included. A fifth group has been added, viz. Canadian Group, represented by Eagle.

Hatton, R. G. 1942. *See* **Amos, J., Hatton, R. G.,** and **Hoblyn, T. N**

463. Haut, I. C. 1940. Variety comparisons of raspberries with respect to yield, hardiness and fruiting period. *Proc. Amer. Soc. hort. Sci.*, **37,** pp. 599-603.
Data are given for yields and season of a range of black and of red raspberries in a 2-year trial in Maryland. Amongst the reds Newburgh and to a lesser extent Taylor suffered considerably more winter injury than Chief and Latham.

464. Hawkins, L. A., and Sando, C. E. 1920. Effect of temperature on the resistance to wounding of certain small fruits and cherries. *Bull. U.S. Dep. Agric.*, **830,** 6 pp. (Condensed from *Exp. Sta. Rec.*, **43,** p. 39.)
The average pressure required to puncture fruits that have been cooled is considerably greater than is required for warm fruit. There are varietal differences between red raspberries in the readiness with which they puncture.

465. Hedrick, U. P. 1900. The Oregon Evergreen blackberry. *Bull. Utah agric. Exp. Sta.*, **64,** pp. 50-4.

466. Hedrick, U. P. 1913. New or noteworthy fruits. I. *Bull. N.Y. St. agric. Exp. Sta.*, **364,** pp. 179-95.
This includes descriptions of June and Plum Farmer raspberries, Perfection and Diploma currants, and Poorman gooseberry.

467. Hedrick, U. P. 1914. New or noteworthy fruits. II. *Bull. N.Y. St. agric. Exp. Sta.*, **385,** pp. 303-13.
This includes descriptions of Chautauqua gooseberry and Chautauqua currant.

468. Hedrick, U. P. 1915. New or noteworthy fruits. III. *Bull. N.Y. St. agric. Exp. Sta.*, **403,** pp. 211-20.
The varieties described include Industry gooseberry, Black Pearl black raspberry and Marldon red raspberry.

469. Hedrick, U. P. 1916. New or noteworthy fruits. IV. *Bull. N.Y. St. agric. Exp. Sta.*, **414,** pp. 3-10.
This includes a description of the Herbert raspberry.

470. Hedrick, U. P. 1916. New or noteworthy fruits. V. *Bull. N.Y. St. agric. Exp. Sta.*, **427,** pp. 523-9.
A description and illustration of the Empire raspberry are included.

471. Hedrick, U. P. 1923. New or noteworthy fruits. VI. *Bull. N.Y. St. agric. Exp. Sta.*, **497,** pp. 3-19.
The Cayuga, Owasco and Seneca raspberries are described.

472. Hedrick, U. P. 1924. New or noteworthy fruits. VII. *Bull. N.Y. St. agric. Exp. Sta.*, **514,** pp. 3-10.
This account includes a description of the Newman red raspberry.

473. Hedrick, U. P. 1925. New or noteworthy fruits. VIII. *Bull. N.Y. St. agric. Exp. Sta.*, **531,** pp. 3-14.
A description is included of the Brant raspberry.

474. Hedrick, U. P. 1925. The small fruits of New York. *Rep. N.Y. St. agric. Exp. Sta.*, **33,** II, 614 pp.

475. Hedrick, U. P. 1928. New or noteworthy fruits. IX. *Bull. N.Y. St. agric. Exp. Sta.*, **551,** 13 pp.
Includes descriptions of Latham and Lloyd George raspberries, and the Fredonia gooseberry.

476. Hedrick, U. P. 1938. Cyclopedia of hardy fruits. The Macmillan Company, New York, 402 pp.

477. Heit, C. E., and **Slate, G. L. 1950.** Treatment of blackberry seed to secure first year germination. *Proc. Amer. Soc. hort. Sci.*, **55,** pp. 297-301.
Sulphuric acid treatment for 1 hr followed by pre-chilling the seed for 1-3 months gave prompt uniform germination. Treatments with vinegar, graino, vitamin B_1, and potassium nitrate were ineffective. Seed treated with concentrated sulphuric acid for 1 hr, sown in peat moss in flats during August and placed in the cold frames until the following March produced the greatest number of seedlings of any treatments, namely 48 and 39% as compared with only 4 and 1% without acid treatment.

478. Heslop-Harrison, Y. H. 1953. Cytological studies in the genus *Rubus* L. I. Chromosome numbers in the British *Rubus* flora. *New Phytol.*, **52,** pp. 22-39.
Somatic chromosome numbers are given for 156 *Rubus* species.

479. Hildebrand, E. M. 1939. Currant mosaic. *Phytopathology*, **29,** pp. 369-71.
Describes a mosaic-like disease of red currant in New York that proved transmissible by inarching. No vector has yet been identified.

480. Hildebrand, E. M., and **Weber, P. V. 1944.** Varietal susceptibility of currants to the cane blight organism, and to currant mosaic virus. *Plant Dis. Reptr*, **28,** pp. 1031-5.
Botryosphaeria ribis was found to have a variety of strains differing in pathogenicity. One highly virulent culture was selected for use in assessing the reaction of currant varieties. A range of varieties was inoculated in 1942, 'insusceptible' varieties being re-inoculated the same year and again in the following year. The following varieties showed immunity, having passed all three tests: *Currants.*—Crandall, Everybody, Fay, Fox New, Knight's Sun Red, La Constante, Littlecroft, Minnesota No. 77, No. 2110, Perfection, Prince Albert, Red Dutch, White Dutch, No. 2327. In addition, Stevens No. 9, White Grape and Pomona were nearly immune.

The following were immune to currant mosaic following transmission by budding: Cherry, Fay, Filler, Fox New, La Hâtive, Laxton's No. 1, Minnesota Nos. 63, 69, 70, and 77, Nos. 1964, 1974, Red Lake, Red Hollandische, Scotch, Stephens No. 9, Versailles, Victoria, White Grape, Wilson's Long Bunch.

Hill, A. R. 1947. *See* **Cadman, C. H.,** and **Hill, A. R.**

481. Hill, A. R. 1952. The bionomics of *Lampronia rubiella* (Bjerkander), the raspberry moth, in Scotland. *J. hort. Sci.*, **27,** pp. 1-13.
Details are given of the life cycle and of the damage caused. The wild

forms of *Rubus* in the east of Scotland (*R. idaeus* and *R. fruticosus*), though not immune, are less severely attacked than cultivated raspberries.

482. Himmelbaur, W. 1911. Notes on the life history of *Ribes pallidum*. *Jb. hamburg wiss. Anst.*, **29** (3), pp. 151-245.

Ribes pallidum [see Zacharias, 1911], a hybrid of *R. petraeum bullatum* and *R. rubrum*, is identical with Red Dutch or Lübeck currant. Lübeck currant shows a tendency for some plants to crop poorly, the small developing fruit abscissing. The difference in yield between the heavy and poor cropping types was not due to extra cytological disturbances in the poor plants.

483. Hirst, F. 1926. The preserving qualities of different varieties of fruit. Canning and bottling trials: I. Raspberries and gooseberries. *J. Pomol.*, **5**, pp. 216-21.

Canning data are given for 27 raspberry varieties. Lloyd George, Calstock Seedling, Baumforth's No. 2, Semper Fidelis, Fastolf, Blackshaw, Bourton Coombe, and Profusion were good for both colour and flavour; Baumforth's No. 1, Devon, Worcester Prolific, and Fillbasket had fairly good colour and good flavour; Prior's Prolific had fair colour and good flavour. The others were all rather poor. Canning and bottling data are given for the gooseberry varieties Early Sulphur, Whinham's Industry, Lancashire Lad, Keepsake, White Lion, Careless, and Crown Bob.

484. Hirst, F., and **Adam, W. B. 1931.** Other fruits: variety canning trials 1931. Preliminary report. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 26-32.

Blackberries. In 1930 Black Diamond gave the best results while Himalayan Giant and Parsley Leaved were disappointing. In 1931 Black Diamond was again the best canning variety, combining relative freedom from woody texture with good flavour. Himalayan Giant from five sources gave very good results. Edward Langley was satisfactory.

Raspberries. Lloyd George gave good uniform results. Pyne's Royal was excellent for colour and flavour but tended to collapse owing to the large hole left after hulling. Norfolk Giant was satisfactory for colour, flavour and firmness. Red Cross was moderately satisfactory. Ellis gave a deep rich red, firm, well flavoured product superior in colour to any other variety for three seasons.

Black currants. Davison's Eight was very satisfactory, with tender skin and very good flavour. Supreme and Westwick No. 15 had tougher skins and a poorer flavour.

485. Hirst, F., and **Adam, W. B. 1932.** Varieties of fruits. Canning trials. *Rep. Fruit Veg. Pres. Sta., Campden*, pp. 17-23.

Gooseberries. The best commercial varieties for canning were Careless and Keepsake, Lancer and Rearguard being rather pale and soft.

Raspberries. Locally grown Lloyd George was excellent, but fruit quality appeared to depend largely on soil. Lord Lambourne, a yellow variety, was poor.

Blackberries. Black Diamond was the best although Himalayan Giant from six sources was nearly as good. John Innes (RT4) was satisfactory; Parsley Leaved, Edward Langley, Beauty and Cotswold Giant were poor.

486. Hirst, F., and **Adam, W. B. 1933.** Varieties of fruits. Canning trials. *Rep. Fruit Veg. Pres. Sta., Campden,* pp. 24-7.

Gooseberries. No variety superior to Careless and Keepsake for canning has yet been discovered; Cousen's Seedling was fairly good but Green Gem was only moderate.

Blackberries. Black Diamond and Himalayan Giant were again outstanding, while John Innes was promising. Parsley Leaved, Edward Langley, Pollaros, and King's Acre were unsatisfactory.

487. Hirst, F., and **Adam, W. B. 1934.** Varieties of fruits. Canning trials. *Rep. Fruit Veg. Pres. Sta., Campden,* pp. 24-30.

Gooseberries. Careless is probably the best for canning, with Keepsake also good; Whinham's Industry and Lancashire Lad are less attractive though the flavour of Whinham's Industry is usually good. Whitesmith gave good colour, flavour and texture, and Ingall's Seedling and Lancer both gave good flavoured products.

Raspberries. Preussen showed poor colour and flavour and the drupelets were large, coarse, seedy and crumbly. Baumforth B transported badly but gave a product with good colour though of poor texture and flavour. Pyne's Royal and Lloyd George were very satisfactory.

Black currants. Laxton's Grape, Wellington XX, Davison's Eight and Baldwin were all good, Daniel's September was fairly good, and Raven and Wellington XXX were fair and rather poor respectively.

488. Hirst, F., and **Adam, W. B. 1947.** Variety trials. Canning and quick freezing. *Rep. Fruit Veg. Pres. Sta., Campden,* pp. 11-18.

Canning: Raspberries. Seven new East Malling raspberry seedlings were tested in 1946 and 1947, none were as good as Norfolk Giant. 51/79 [Promise], E [Enterprise] and K were fairly good; J [Jewel], L [Landmark], M, and N [Notable] were less satisfactory.

Quick freezing: Raspberries. Norfolk Giant proved superior to seven East Malling seedlings. However, E, J, and M were good; G and K were moderate, and L was rather poor.

489. Hoar, C. S. 1916. Sterility as a result of hybridization and the condition of pollen in *Rubus. Bot. Gaz.*, **62,** pp. 370-88. (Condensed from *Exp. Sta. Rec.*, **37,** p. 131.)

Work on some 40 species of *Rubus* showed that pollen sterility is common throughout the genus. Hybrids between distinct *Rubus* species are almost entirely sterile, while crosses of closely related and supposedly more compatible varieties may give almost no indication of a hybrid origin.

490. Hoar, C. S. 1916. Evidences of hybridism in the genus *Rubus.* (Abstr. in *Science, N.S.* **43,** pp. 290, 291.) (From *Exp. Sta. Rec.*, **35,** p. 227.)

The author presents morphological data considered to favour strongly the occurrence of widespread hybridism in the genus *Rubus.* There is believed to be good evidence from the standpoint of extreme variability and correlated gametic sterility, of widespread natural hybridism in this genus.

Hoblyn, T. N. 1942. *See* **Amos, J., Hatton, R. G.,** and **Hoblyn, T. N.**

Hockey, J. F. 1922. *See* **Rankin, W. H.,** and **Hockey, J. F.**

491. Hönings, J., and **Macherauch, O. 1926.** (Gooseberries resistant to mildew.) *Prakt. Ratg. Obstb.*, **41,** pp. 386-7. (Condensed from *Rev. appl. Mycol.*, **6,** p. 495.)
The only gooseberries found to have much resistance to *Sphaerotheca mors-uvae* were certain small, red-berried ones; notably Mountain Seedling, Rambullion, Houghton, Downing, Small Red Globe, and Red Jacket. Some resistance was shown by Rote Preiselbeere, Crown Prince, Red Orleans, May Duke, Grüne Flaschenbeere, Lady Delamere, Höning's Früheste, Macherauch's Sämling, and Weisse Volltragende. Höning's Früheste stands concentrated applications of lime-sulphur.

492. Hooker, H. D. (Jr.). 1920. Pentosan content in relation to winter hardiness. *Proc. Amer. Soc. hort. Sci.*, **17,** pp. 204-7.
Determinations of the pentosan content of shoots of tender and hardy varieties of currant and raspberry, showed that hardier plants have more pentosan.

493. Hooper, C. H. 1911. Experiments in the pollination of our hardy fruits. *Agric. Students Gaz. Wye, N.S.* **15,** pp. 110-13.
Gooseberries, red currants and white currants fruit well under self-fertilization.

494. Hooper, C. H. 1913. The pollination and setting of fruit blossoms and their insect visitors. *J. roy. hort. Soc.*, **38,** p. 238.

495. Hooper, C. H. 1920. Notes on insect visitors to fruit blossoms. *J. Pomol.*, **1,** pp. 116-24.

496. Howe, G. H. 1929. New or noteworthy fruits. X. *Bull. N.Y. St. agric. Exp. Sta.*, **578,** 12 pp.
Descriptions are included of Newburgh and Viking raspberries.

497. Howe, G. H. 1933. New or noteworthy fruits. XI. *Bull. N.Y. St. agric. Exp. Sta.*, **620,** 18 pp.
The Naples black raspberry is described.

Huber, G. A. 1937. *See* **Schwartze, C. D.,** and **Huber, G. A.**

498. Huber, G. A., and **Schwartze, C. D. 1938.** Resistance in the red raspberry to the mosaic vector *Amphorophora rubi* Kalt. *J. agric. Res.*, **57,** pp. 623-33.
It was shown that varieties of red raspberry possess various degrees of resistance to *A. rubi* in Western Washington. In the greenhouse *A. rubi* failed to reproduce and maintain its population on Indian Summer, Lloyd George, Pyne's Imperial and Pyne's Royal. Reproduction was slow and the population remained small on Antwerp, Herbert, Marcy and Newburgh. Aphids fed and reproduced abundantly on Cayuga, Chief, Cuthbert, June, Katherine, King, Latham, Laxton's Bountiful, Laxton's Renown, Laxton's Reward, Marlboro, Newman, Preussen, Ranere (St. Regis), Red Cross, Rote Riesen, Seneca, Taylor, and Viking.
In experimental plots and commercial plants, *A. rubi* was found not to feed on those varieties that showed high resistance to the aphid in the greenhouse; populations were small on those which had shown partial

resistance in the greenhouse and comparatively large on the susceptible varieties.

Greenhouse and field observations showed resistance to be inherited when a resistant variety was crossed with a susceptible. Lloyd George was found to be heterozygous for resistance.

Huber, G. A. 1939. *See* **Schwartze, C. D.,** and **Huber, G. A.**

499. Hudson, J. 1904. Autumn fruiting raspberries and strawberries. *J. roy. hort. Soc.*, **28,** pp. 402-6.
Cultural methods for autumn raspberries are given. Varieties described are October Red, Belle de Fontenay and Surprise d'Automne, a yellow fruited variety.

500. Hudson, J. P. 1947. The story of a raspberry variety. *N.Z. J. Agric.*, **75,** pp. 179-80.
Stocks of virus-free Lloyd George, re-introduced into Britain from New Zealand in 1945, were established at East Malling Research Station.

501. Hudson, J. P. 1950. Bringing back the Lloyd George raspberry—New Zealand roots grow well here. *Grower*, **34,** pp. 159-60.

502. Hudson, J. P. 1953. Factors affecting regeneration of root cuttings. *Nature, Lond.*, **172,** pp. 411-12.
A method of propagating raspberries from root cuttings is described.

503. Hudson, J. P. 1954. Propagation of plants by root cuttings. I. Regeneration of raspberry root cuttings. *J. hort. Sci.*, **29,** pp. 27-43.

504. Hudson, J. P. 1955. Propagation of plants by root cuttings. II. Seasonal fluctuation of capacity to regenerate from roots. *J. hort. Sci.*, **30,** pp. 242-51.
Regeneration of raspberries from root cuttings is discussed.

505. Hunter, A. W. S. 1943. Rust resistant black currants. *Canad. Hort. and Home Mag., Growers' Ed.*, **66** (1), p. 10.

506. Hunter, A. W. S., and **Davis, M. B. 1943.** Breeding rust resistant black currants. *Proc. Amer. Soc. hort. Sci.*, **42,** pp. 467-8.
Ribes ussuriense Jancz. (one plant only) proved immune to *Cronartium ribicola*; plants tentatively identified as *R. aureum* and *R. odoratum* showed some resistance [cf. Hunter, 1950c]. Crosses of *R. ussuriense* with Boskoop Giant and with Kerry gave 45 and 168 plants respectively and all were highly resistant. Kerry × *ussuriense* gave 124 with no rust to 6 susceptibles; Kerry × (?) *aureum* gave 7: 5 and Boskoop Giant × (?) *odoratum* gave 0: 20. Most of the seedlings proved susceptible to powdery mildew, but some were only slightly affected. Susceptibility to *Cronartium* was not correlated with susceptibility to powdery mildew.

507. Hunter, A. W. S. 1944. More about the new Ottawa raspberries. *Canad. Hort. and Home Mag., Growers Ed.*, **67** (9), pp. 193-4. (From *Exp. Sta. Rec.*, **92**, p. 657.)
In February 1943 five new red raspberries developed by the Central

Experimental Farm, Ottawa, were named Rideau, Trent, Madawaska, Ottawa and Gatineau. All except Ottawa had Lloyd George as one parent. Madawaska, because of its hardiness and other qualities, is considered the most promising of the five new varieties.

508. Hunter, A. W. S. 1950. Small fruits: Raspberries. *Prog. Rep. Cent. Exp. Fm, Ottawa, 1934-48*, pp. 24-6.

Five seedlings from crosses made in 1926 and 1927 were named in 1943; two others, still under introduction number, have attracted attention:

Gatineau (0-276) Madawaska (0-272) Rideau (0-262)	Lloyd George × Newman 23
Trent (0-264) 0-263	Newman 23 × Lloyd George
Ottawa (0-275)	Viking × (Loganberry × St. Regis)
0-201 [Muskoka]	Newman 23 × Herbert

The Lloyd George-Newman 23 varieties resemble Lloyd George in having purple thorns on new canes and in having thick-walled conical berries. Ottawa has fruit similar to that of Viking but is hardier. Gatineau, Madawaska, Trent, and 0-263 are early maturing. Ottawa, Rideau, and 0-201 are midseason varieties. Madawaska, 0-201, and 0-263 are particularly hardy. All are satisfactory for freezing and Madawaska is outstanding for jam purposes.

Breeding is based on large populations of seedlings and Lloyd George has been found outstanding as a parent, especially in the combination Lloyd George × Newman 23.

A replicated disease resistance survey was carried out in 1943, 1944, and 1945 on 13 varieties surrounded by guard rows of other varieties for which data are included.

Mosaic. Herbert, Indian Summer, Madawaska, Marcy, Milton, Tahoma, Trent, and Washington showed no symptoms.

Late Yellow Rust (*Pucciniastrum americanum*). Ottawa was severely attacked, Viking is moderately susceptible and five out of ten seedlings with Viking ancestry exhibit some susceptibility. Chief, Latham, Newburgh, and Newman 23 showed a trace to slight infection. All other varieties were completely free.

Powdery mildew (*Sphaerotheca humuli*). Ottawa was susceptible, Latham and Viking slightly susceptible; no mildew was found on any other variety.

Anthracnose (*Elsinoë veneta*). Lloyd George-Newman 23 hybrids (Gatineau, Madawaska, Marcy, Rideau, Taylor, and Trent) were moderately to highly susceptible. Washington was the most susceptible variety. Chief, Latham, Monroe, Newburgh, Newman 23, Ottawa, and Viking showed only slight infection.

Spur blight (*Didymella applanata*). Madawaska, Rideau and Taylor were most susceptible; no immunity was found.

509. Hunter, A. W. S. 1950. Small fruits: Gooseberries. *Prog. Rep. Cent. exp. Fm, Ottawa, 1934-48*, pp. 29-30.

The sole objective in gooseberry breeding at Ottawa has been thornlessness.

In 1918 the English variety Victoria was crossed with a thornless plant of *R. oxyacanthoides* L. Some F_2 plants were thornless. From the cross of one of these with the American variety Mabel, the almost completely thornless variety Spinefree [Davis, 1926a] was produced. Spinefree crossed with Clark, an English type, gave 64 thorny: 37 almost thornless seedlings. Six of these had fruit equal in size to the best American varieties. The thorns of these 6 'thornless' types are so short that they do not interfere with fruit picking. 'No precise information has been obtained on the inheritance of thorns in the gooseberry, but it is evident that thornlessness is recessive. . . . It is also evident, from the different degrees of thorniness encountered, that several pairs of genes are involved.'

510. Hunter, A. W. S. 1950. Small fruits: Black currants. *Prog. Rep. Cent. exp. Fm, Ottawa, 1934-48*, pp. 26-9.
Resistance to *Cronartium ribicola* was found in a seedling of *Ribes ussuriense*, a black currant from Siberia, and in the red currant variety Viking. Selections 0-381 and 0-393 both from the F1 of *R. ussuriense* × Kerry were widely distributed in 1945. In no case has rust been found on either variety in any locality, and both appear to be completely immune. These varieties have been named Crusader and Coronet respectively; detailed descriptions are given. Rust immunity is dependent on a single dominant gene for which no symbol is suggested.

A report by Hunter and Davis (1943) recording resistance from the cross Kerry × *R. aureum* and Boskoop Giant × *R. odoratum* is discounted since the parentage of the material is in doubt.

511. Hunter, A. W. S. 1950. Small fruits: Red currants. *Prog. Rep. Cent. exp. Fm, Ottawa, 1934-48*, p. 29.
Crosses between Viking and Cascade, Red Lake, and Stephens No. 9 all proved resistant to *Cronartium ribicola*. Viking shows some aphid resistance. The cross Viking × Stephens No. 9 showed variation in aphid susceptibility and one markedly resistant plant appeared. The wild northern Asian species *R. diacanthum* also appears aphid resistant.

512. Hunter, A. W. S., and White, F. H. 1950. Breeding for disease resistance in Canada. III. Horticultural crops and tobacco. *Emp. J. exp. Agric.*, **18**, pp. 218-26.
Lloyd George-Newman 23 hybrids, such as Madawaska, Marcy, Rideau, Taylor, and Trent are susceptible to anthracnose (*Elsinoë veneta*) and spur blight (*Didymella applanata*) but highly resistant to late yellow rust (*Pucciniastrum americanum*) and powdery mildew (*Sphaerotheca humuli*). Viking and many of its seedlings, including the variety Ottawa, are susceptible to late yellow rust and powdery mildew. Latham is susceptible to powdery mildew. The two latter groups are relatively resistant to anthracnose and spur blight.

Crusader and Coronet black currants have proved completely resistant to *Cronartium ribicola* over a wide range of conditions; resistance is dominant and monogenic.

513. Hunter, A. W. S. 1955. Gooseberries. *Prog. Rep. Cent. exp. Fm, Ottawa, 1949-53*, p. 28.
Captivator (0-272) has good-sized, thick-skinned, pear-shaped fruits that turn dull red when ripe. It is thornless except for a short distance at the base of the canes.

In a yield trial planted in 1949, the five thornless varieties, Captivator, 0-271, 0-273, 0-274, and 0-275, equalled or exceeded the commercial varieties Clark, Fredonia and Poorman. The fruit is rather small, however, and the thornless varieties appear more susceptible to foliage diseases. They are not hardy on the Prairies.

514. Hunter, A. W. S. 1955. Black currants. *Prog. Rep. Cent. exp. Fm, Ottawa, 1949-53*, pp. 28-9.
The rust resistant varieties Crusader and Coronet have been found to require cross pollination to set a crop. Both are mildew susceptible.

Consort (0-396) from Kerry × *Ribes ussuriense* Jancz. is immune to *Cronartium ribicola* A. Fisch. but susceptible to *Sphaerotheca mors-uvae* (Schw.) Berk. and Curt. It yields well, is good for jam and jelly, and will set a good crop even in the absence of pollinating insects.

Two sources of resistance to *S. mors-uvae* in *R. nigrum* are reported. One was found in a plant grown from seed from Poland and the other from a variety obtained from a Saskatchewan nursery.

515. Hunter, A. W. S. 1955. Rust resistance inheritance in black currants. *Prog. Rep. Cent. exp. Fm, Ottawa, 1949-53*, p. 59.
Four backcross progenies of Crusader and Coronet to the susceptible varieties Kerry and Magnus gave a total of 700 resistant seedlings: 628 susceptible. One family Coronet × Kerry gave an aberrant ratio (186: 122): the remaining families totalled 514: 506.

516. Hylander, H. 1955. (*Rubus plicatus* its formenkreis and related species.) *Bot. Notiser*, **108,** pp. 341-80.
A survey of the taxonomy of *R. plicatus* and allied species, and of hybrids between it and *R. caesius*, *R. sulcatus* and *R. idaeus*.

517. Ingram, C. 1954. A new *Rubus* hybrid. *J. roy. hort. Soc.*, **79,** pp. 540-1.
The cross *Rubus deliciosus* × *R. trilobus* gave a seedling resembling *R. deliciosus* in foliage but with better flowers, many of which opened together.

518. Jakovličeva, N. G. 1952. (The cultivation of gooseberry in the Komi-Permjackiĭ National District.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 3, p. 75. (Condensed from *Plant Breed. Abstr.*, **22,** p. 448.)
Seedling selection of Houghton has given the mildew resistant Kudymkarskiĭ Prevoshodnyĭ. Other promising material includes the hardy, mildew-resistant Sejanec Finika 1 selected from Finik Zelenyĭ.

519. Janczewski, E. de. 1901. (Hybrids of currants.) *Bull. int. Acad. Sci. Cracovie*, pp. 295-303.

520. Janczewski, E. de. 1904. (Hybrids of currants. II.) *Bull. int. Acad. Sci. Cracovie*, pp. 22-31.

521. Janczewski, E. de. 1907. (Monograph of the currants *Ribes* L.) *Mem. Soc. Phys. et Hist. Nat. de Genève*, **35,** pp. 199-517.

522. Janczewski, E. de. 1909. (Supplement to the monograph of currants. I. New species and hybrids.) *Bull. int. Acad. Sci. Cracovie*, pp. 60-75.

523. Janczewski, E. de. 1912. (Supplements to the monograph of currants. IV. New hybrids.) *Bull. int. Acad. Cracovie 1911, B*, pp. 612-19.

Five new interspecific *Ribes* hybrids are described. They are: *Ribes vitreum* (*R. grossularia* × *R. stenocarpum*), in the sub-genus *Grossularia; R. australe* ♂ (*R. gayanum* ♀ × *R. polyanthes* ♂), *R. chrysanthum* ♂ (*R. integrifolium* ♀ × *R. polyanthes* ♂), and *R. luteum* (*R. integrifolium* ♀ × *R. valdivianum* ♂) in the sub-genus *Parilla*; *R. wallichii* (*R. glaciale* ♀ × *R. luridum* ♂) in the sub-genus *Berisia*.

R. australe, *R. chrysanthum* and *R. luteum*, are all deciduous like their pollen parents, whereas the seed parent in each case is evergreen. It seems that in the sub-genus *Parilla*, deciduous leaves are dominant over evergreen.

524. Janczewski, E. de. 1917. (A hybrid between a dioecious and a hermaphrodite currant.) *Bull. int. Acad. Cracovie, 1916, B*, pp. 98-104.

After briefly reviewing previous work in hybridizing various dioecious and monoecious species the author describes a natural hybrid, *Ribes berisioides* from *R. alpinum* ♀ × *R. grossularia* ♂. The one F_1 seedling raised to maturity is female and spineless. The backcross to *R. grossularia* was unsuccessful.

525. Jeffers, W. F. 1953. Diseases of berries in the east. *Yearb. U.S. Dep. Agric.*, pp. 775-83.

Most black raspberries are very susceptible to mosaic. Of the red raspberries, Indian Summer, Lloyd George, Antwerp, Herbert, Marcy, and Newburgh are poor hosts for the vector, *Amphorophora rubi*; they are usually not infected with mosaic. Latham, though often infected, is usually less severely injured than Cuthbert, Taylor, Chief, June and others.

Mild streak, a serious virus disease of black raspberries, does not affect red raspberries.

Most black raspberries are susceptible to *Verticillium albo-atrum*; red raspberries are more resistant—Cuthbert and Syracuse are highly resistant, Latham is rather less so. Most blackberries are not severely affected.

Anthracnose, *Elsinoë veneta*, is most severe on black raspberries, though red raspberries, purples, blackberries and other brambles are also susceptible. The Quillen black raspberry is said to be resistant. Amongst red raspberries Cuthbert, Ranere and Turner are usually not severely injured.

Spur blight, *Didymella applanata*, is particularly injurious to red raspberries but black raspberries are not generally affected.

Leaf spot, *Septoria rubi*, is usually more serious on red than on black raspberries. Ranere is resistant and there are marked differences in varietal response.

Orange rust (*Gymnoconia interstitialis*) attacks black raspberries and other brambles but not red raspberries. Eldorado, Snyder, Evergreen (Black Diamond) and Lawton blackberries, and the Lucretia dewberry are resistant.

Red raspberries are much more susceptible to powdery mildew than blacks.

Double blossom, *Cercosporella rubi*, attacks blackberries and dewberries, but not raspberries.

Jensen, D. D. 1948. *See* **Wilhelm, S., Thomas, H. E., and Jensen, D. D.**

526. Jinno, T. 1950. On the polyploidy in *Rubus*. *Mem. Ehime Univ. Sect. II (Sci.)*, **1,** pp. 43-6.

527. Jinno, T. 1951. (Chromosomes in *Rubus*. I.) *Senshokutai* (Chromosome), Nos. 9-10, pp. 360-1. (From *Plant Breed. Abstr.*, **24,** p. 460.)
The following counts are reported: *R. hirsutus* and *R. parvifolius*, 2n=14; *R. sieboldii*, 28; *R. pectinellus*, 42; and *R. buergeri*, 56.

528. Jinno, T. 1951. (Chromosomes in *Rubus*. II.) (*Jap. J. Genet.*), **26,** pp. 133-5. (From *Plant Breed. Abstr.*, **24,** p. 118.)
Figures and brief descriptions are given of the metaphase chromosomes of *R. illecebrosus*, *R. wrightii*, *R. phoenicolasius*, *R. palmatoides*, *R. commersonii*, *R. ribifolius*, *R. faurieri*, and *R. trifidus* (all 2n=14), and of *R. hakonensis* and *R. pseudosieboldii* (2n=56).

529. Johansson, E. 1930. (Raspberry variety trials.) *Sverig. Pomol. Fören. Årsskr.*, **31,** pp. 185-97. (Condensed from *Hort. Abstr.*, **1,** pp. 40-1.)
An account of trials at Alnarp and Djurön from 1924 to 1930. Pyne's Royal and Lloyd George were found particularly well suited to Swedish conditions. Baumforth B, though excellent in flavour, was inferior in yield. Hornet lacked uniformity. Superlative was intermediate among the five varieties tested.

530. Johansson, E. 1947. (Mitra and Miranda—two new Swedish raspberry varieties.) *Sverig. Pomol. Fören. Årsskr.*, **48,** pp. 131-9. (Condensed from *Plant Breed. Abstr.*, **19,** p. 392.)
Crosses made at Alnarp in 1930 have resulted in the varieties Miranda, from Marlboro × Pyne's Royal, and Mitra, from Pyne's Royal × Superlative. Miranda is a good cropper with medium to large, roundish, bright red fruits which ripen a few days later than Marlboro. Mitra has large, rather long conical, dark red, firm fruits and ripens a day or two earlier than Superlative. Miranda has large drupelets and is crumbly, Mitra has medium sized drupelets.

531. Johansson, E. 1949. (Variety trials with raspberries at Alnarp 1937-48.) *Medd. Trädgårdsförs. Malmö*, **56,** pp. 215-28. (Condensed from *Hort. Abstr.*, **20,** p. 17.)
In two trials St. Walfried showed the highest mean yield followed by Lloyd George, the difference not being significant. Both varieties became progressively affected by virus while Baumforth B remained healthy, produced berries of a good flavour, but yielded poorly.

532. Johansson, E. 1949. (Variety trials with raspberries at Alnarp 1937-1948.) *Försök och Forskning*, **6,** pp. 46-7, also *Berätt Alnarps Lantbr., Mej. O. Trädgårds Inst. 1949 (1950)*, pp. 215-28. (Condensed from *Plant Breed. Abstr.*, **20,** p. 802.)
Chlorotic symptoms were noted in Preussen and St. Walfried, the former being specially unsuitable for soil with a high calcium content. Lloyd George, Preussen and St. Walfried were also affected by virus diseases. Baumforth B gave poor yields. The sweetest variety was Preussen, and La France the sourest. St. Walfried is recommended for yield and quality provided fresh material can be imported. Preussen is also approved on the basis of results in other trials and in practice. In further trials still in

progress at five other sites St. Walfried and Marlboro have given good yields.

533. Johansson, E. 1950. Fruit growing in Sweden. *Fruit Yearb.*, Roy. Hort. Soc. Lond., pp. 45-53.

Acreages, yields and cultural methods for gooseberries, currants, raspberries and blackberries are briefly described.

Numerous foreign gooseberry varieties are grown. Three mildew resistant Swedish varieties are: Landström which is green, thin-skinned and of good flavour; Centum which is green and sweet; and Scania, a red variety.

Boskoop Giant is the most widely cultivated black currant. The Finnish variety, Brödtorp, is hardy, early and heavy yielding but is prostrate in habit. Janslunda, a Swedish variety, is sweet flavoured but also rather prostrate.

Red Cross and Earliest of Fourlands are the most commonly grown red currants. The former is hardy in northern Sweden.

Preussen and Lloyd George raspberries are grown in south Sweden, while Asker and Marlboro are more widely grown in the north. Two promising new varieties, Mitra and Miranda, raised at Alnarp in 1930, are described.

534. Johansson, E. 1951. (Variety trials with black currants.) *Försök och Forskning*, **8,** pp. 20-1. (Condensed from *Plant Breed. Abstr.*, **21,** p. 956.)

On clay soils in southern Sweden the Wellington varieties and Silvergeiter were the best, while in central Sweden Wellington and Brödtorp were the most suitable. For northern Sweden Brödtorp is recommended as being hardy and productive but Wellington could also be grown there in many cases. Brödtorp is suitable also for southern Sweden as an early ripening variety.

535. Johansson, E. 1951. (Variety trials with black currants.) *Medd. Stat. Trädgårdsförsök*, No. **64**, 26 pp. (Condensed from *Plant Breed. Abstr.*, **22,** p. 288.)

Boskoop Giant and the highly winter-hardy variety Brödtorp were the earliest ripening; Baldwin, Wellington XX and Danish September were late. Danish September showed the highest mean vitamin C content. Brödtorp was generally first in yield in the early years after planting.

536. Johansson, E. 1952. (On raspberry and blackberry cultivation and breeding in the U.S.A.) *Sverig. Pomol. Fören. Årsskr. 1952*, pp. 93-9.

537. Johansson, E., and **Bergelin, E. 1953.** (Variety trials with gooseberries.) *Medd. Trädgårdsförs.*, No. **77**, 20 pp. (Condensed from *Plant Breed. Abstr.*, **23,** p. 629.)

Data are given for 10 variety trials carried out at different places in Sweden over different periods of years. The hardiest varieties were American Mountain gooseberry, Scania, Champion, Triumphant and Industry. Whitesmith, graded as fairly hardy, held its own as regards yield and quality in most of the trials. A list of 34 varieties shows the colour, size and quality of the fruits of many of the varieties included in these trials.

538. Johnson, F. 1953. Diseases of berries in the west. *Yearb. U.S. Dep. Agric.*, pp. 770-5.

When first introduced in 1938, Washington was resistant to yellow rust (*Phragmidium rubi-idaei*) but by 1944 a new strain of the fungus infected it. Willamette and Tahoma are resistant.

Anthracnose (*Elsinoë veneta*) is worse on black than on red raspberries. Green mosaic is most prevalent on Cuthbert.

Certain clones of the wild Pacific coast trailing blackberry, *Rubus ursinus*, and the dewberry varieties, Boysen, Young and Nectar, are highly susceptible to *Verticillium albo-atrum*. Varieties of black and red raspberry also become infected, but Cuthbert is tolerant. Other resistant or immune types include clones of the wild trailing blackberry, Logan, Mammoth, Chehalem, Himalaya, and cut-leaved Evergreen.

Both cut-leaved and broad-leaved Evergreen are susceptible to leaf rust, *Kuehneola uredinis*, as are Chehalem and some clones of *R. ursinus*; nine dewberry varieties and Himalaya proved immune.

Stamen blight, *Hapalosphaeria deformans*, occurs on Boysen, Young, and the cut-leaf Evergreen; it has occasionally been found on *R. ursinus*.

Descriptions of symptoms and control of these and of a number of other diseases are given.

539. Johnston, S. 1931. The value of plant and tip selection in the propagation of the black raspberry. *Quart. Bull. Mich. agric. Exp. Sta.*, **13,** pp. 195-9.

There proved to be no value in selecting extra-productive parent plants or extra-large tips, provided the parent plant was healthy.

540. Joley, L. E., and **Close, A. W. 1941.** The rooting response of various species of *Rubus* to conventional methods of propagation. *Proc. Amer. Soc. hort. Sci.*, **38,** pp. 420-3.

541. Jones, D. F., and **Singleton, W. R. 1940.** The improvement of naturally cross-pollinated plants by selection of self-fertilized lines. III. Investigations with vegetatively propagated fruits. *Bull. Conn. agric. Exp. Sta.*, **435,** pp. 327-47.

In raspberry breeding Ranere (red), Columbian (purple), and Cumberland (black) were selfed for from 1 to 3 years. Ranere and Columbian seedlings showed marked depression in vigour. Cumberland retained full vigour and production through three generations of selfing. All three showed considerable segregation. In the first generation of selfing from Columbian, 57 seedlings were grown and they ranged from nearly red to true black, with various degrees of bloom. All were less vigorous than Columbian. In the self-bred generation from Cumberland many plants were badly stunted by mosaic. Of 86 healthy plants, 2 were more thorny than Cumberland, 54 were similar to Cumberland, 20 were less thorny, 9 had few thorns and 1 had almost no thorns. In stem colour 57 were red, 12 green, 16 greenish red, 1 blue green. Young leaves on new sprouts gave 59 green: 17 red: 7 light red. There was much variation in time of flowering, appearance of ripe fruit and in size of berry. About half the progeny showed complete fertility. The most promising selfed lines of black raspberries were crossed with Ranere, Newman, Erskine Park, and Herbert (all red varieties). Most of the F_1 plants were purple but some were dark red and a few were black.

A cross of inbred black with Columbian purple gave 21 black: 63

purple, but the purples were highly variable, ranging from the parental purple to almost black, and some were so heavily covered with bloom as to appear dusty. Partial sterility occurred in some plants.

Promising bright-red-fruited raspberries were produced from hybrids of black and red raspberries backcrossed to reds, but many of these would not tip-layer and produced no spawn.

Crosses were made reciprocally between locally grown blackberries and red, purple and black raspberries. The varieties used were: blackberries—Snyder, Eldorado, Blowers, and Mersereau; red raspberries—Latham, Cuthbert, Newman, La France, and Erskine Park; the Columbian purple and Cumberland black were also used. Only crosses of Newman, La France, and Erskine Park with the various blackberries produced true hybrids. Several hundred hybrids were grown; they were extremely diverse, ranging from low stiff-caned bushes with numerous branching stems to plants with long trailing stems and few branches. Many plants were notably susceptible to rust but some were entirely rust free, winter hardy and exceptionally vigorous. In nearly every case the thorns were larger and more numerous than those of either parent. Some of the plants were sterile and partial sterility was common. Fruit colour was mostly dark red verging on black and flavour was strong and acid, plugging was bad and the fruit was crumbly. Open pollinated seed from these F_1s was sown but no promising plants appeared. Colchicine treatment gave no satisfactory results.

Jones, H. A. 1953. *See* **Stevenson, F. J.,** and **Jones, H. A.**

542. Jones, L. K. 1924. Anthracnose of cane fruits and its control on black raspberries in Wisconsin. *Res. Bull. Wis. agric. Exp. Sta.*, **59,** 26 pp.

Anthracnose (*Plectodiscella* [*Elsinoë*] *veneta*) attacks black raspberries, blackberries, red raspberries and purples. Under Wisconsin conditions the black raspberry is the most susceptible host and no varieties have been found resistant. Optimum temperature for mycelial growth on dextrose-potato agar is 20-26° C. Conidia germinate readily on nutrient media; ascospores germinate by producing 5-7 conidia. Incubation on the canes takes 3-9 days, the disease first appearing when the canes are 8-10 in. high. The lesions increase in number on the young shoots during early summer, resistance being developed with the cessation of growth in July. Ascospores and conidia form a source of natural inoculum in the spring and early summer, the ascigerous stage being an important factor in overwintering the disease. High summer temperatures may be important in checking the disease.

543. Jones, L. K., and **Baur, K. E. 1936.** Mosaic and related diseases of raspberries in Washington. *Bull. Wash. St. agric. Exp. Sta.*, **324,** 19 pp.

Mosaic is the most serious virus of raspberries in Washington though leaf-curl, yellow mosaic and streak also occur. The spread of mosaic is more rapid on black than on red raspberries. Of the red raspberries, Cuthbert and Marlboro were the most seriously damaged; Latham, Chief, Syracuse, Newburgh and Antwerp were less affected, and Lloyd George was free. Of the black raspberries, Plum Farmer and Munger were seriously damaged; Cumberland, Dundee, Naples and Ohio were less affected.

544. Jørgensen, C. A., and **Weber, A. 1929.** (Investigations on raspberry cane blight.) *Tidsskr. Planteavl*, **35**, pp. 582-614. (Condensed from *Rev. appl. Mycol.*, **9**, pp. 116-18.)
A comprehensive account of the etiology, biology and control of cane blight (*Didymella applanata*). Goliath, Superlative and Stedsebaerende (Everbearing) from Feldbrünnen have been found highly susceptible, Søholt, Hornet, Harzjuwel and Baumforth's Seedling moderately so, while two strains of Fajstrup and Kejserinde Dagmar (a cross between Fajstrup and Superlative) are very resistant.

545. Jørstad, I. 1923. (Report on plant diseases in agriculture and horticulture 1920-22. II. Fruit trees and small fruits.) Grøndahl and Søns Boktrykkeri, Christiania, 73 pp. (Condensed from *Rev. appl. Mycol.*, **3**, pp. 255-8.)
Rust (*Puccinia ribis*) is severe on red currants in some Norwegian coastal regions. *P. caricis* also occurs on red currants though in a much milder form than on gooseberry; it has only twice been reported on black currants. *Caeoma ribesii* was noted on red currants, gooseberries, *Ribes alpinum* and on *R. pubescens*. *Cronartium ribicola* and *Sphaerotheca mors-uvae* were reported on red currants, the latter disease causing considerable damage to Raby Castle. Leaf spot (*Septoria ribis*) was prevalent on red and black currants and on gooseberries. The Red Dutch Grape currant was comparatively resistant to *Gloeosporium ribis*; on black currants this disease was most severe on Lee's Prolific and Boskoop Giant; Bang Up, Goliath and Edina proved relatively resistant.

546. Jørstad, I. 1928. (Report on plant diseases in agriculture and horticulture. V. Economic horticultural plants.) Grøndahl and Søns Boktrykkeri, Oslo, 68 pp. (Condensed from *Rev. appl. Mycol.*, **7**, pp. 699-701.)
Raspberry mosaic, first observed in 1908, is very prevalent on Marlboro. Varietal reaction to the disease apparently fluctuates with meteorological and soil conditions, Marlboro being particularly susceptible in acid soils and during seasons when the early summer is dry.

547. Jørstad, I. 1935. (Report on fungous diseases of forest trees in the years 1931-1935.) *Beretn. Norsk. Skogv.*, pp. 83-100. (Condensed from *Rev. appl. Mycol.*, **15**, pp. 617-19.)
White currants (Dutch Grape), *Ribes aureum*, and *R. sanguineum* were attacked by *Cronartium ribicola*, but the common red currant (Viking) was immune.

548. Kaner, R. 1941. (*Rubus* studies in north-western Scania.) *Bot. Notiser*, pp. 367-74.

549. Kaner, R. 1953. (On the interpretation of *Rubus pruinosus* Arrh.) *Bot. Notiser*, pp. 233-7. (From *Plant Breed. Abstr.*, **23**, pp. 628-9.)
The author believes *R. pruinosus* to be a hybrid series from *R. caesius* × *R. idaeus* crossed with any one of the following species: *R. nemorosus*, *R. ciliatus*, *R. tiliaceus*, *R. wahlbergii* or *R. ambifarius*.
Brief descriptive notes are given on the five triple hybrids, with, when known, their chromosome numbers determined by Å. Gustafsson. The cross *R. caesius* × *R. idaeus* gives a very low set of fruit, but, when crossed with a third species, fertility is good and, in the rare triple hybrid with *R. wahlbergii*, even very good.

550. Kaplan, R. W. 1953. (On the potentialities of mutation induction in plant breeding.) *Z. Pflanzenz.*, **32** (2), pp. 121-31.
X-ray treatment of cuttings and seedlings of *Ribes nigrum* caused variation in leaf colour, shape, size, and pose and in growth habit. Favourable characters induced included shorter (or longer) internodes, longer inflorescences, and, in Goliath, better flavour. Undesirable changes included greater susceptibility to fungal attack and sometimes a decrease in yield (although this was sometimes improved). The number of seeds per fruit was often decreased.

Katinskaya, J. K. 1936. *See* **Bologovskaya, R. P., Katinskaya, J. K., Pavlova, N. M.,** and **Rozanova, M. A.**

Keilholz, F. J. 1928. *See* **Mumford, H. W.,** and **Keilholz, F. J.**

Kendall, L. 1950. *See* **Crang, A., Kendall, L.,** and **Sturdy, M.**

Kennard, W. C. 1950. *See* **White, D. G.,** and **Kennard, W. C.**

551. Kerr, E. A. 1954. Seed development in blackberries. *Canad. J. Bot.*, **32,** pp. 654-72.

Kiece, V. T. 1955. *See* **Taronova, E. A.,** and **Kiece, V. T.**

552. Kimmey, J. W. 1935. Susceptibility of principal *Ribes* of southern Oregon to white-pine blister rust. *J. For.*, **33,** pp. 52-6. (Condensed from *Rev. appl. Mycol.*, **14,** p. 410.)
A total of over 300 plants of *Grossularia klamathense*, *Ribes marshallii*, *R. sanguineum*, *R. hallii*, *R. binominatum*, *R. erythrocarpum*, *R. velutinum*, and *R. cruentum* were exposed to severe natural infection of *Cronartium ribicola* from *Pinus monticola*. All the species proved highly susceptible, except *R. hallii*, and all (including the latter) produced a large or moderate number of teleutosori on the diseased leaves.

553. Kimmey, J. W. 1938. Susceptibility of *Ribes* to *Cronartium ribicola* in the West. *J. For.*, **36,** pp. 312-20.
Tests were carried out on 51 species and forms of *Ribes* in British Columbia and Oregon, and lists are given showing the order of their susceptibility and their capacity to produce telia.

Within a species, the part-shade form (less often the shade form) was usually the most susceptible and normally produced the most telia, the open form being the most resistant and usually producing the fewest. Of the species tested, *R. nigrum* was the most susceptible and produced the most telia, while the open form of *R. cereum* was the most resistant and produced the fewest. Other susceptible species included *R. klamathense*, *R. marshallii*, *R. cruentum*, *R. binominatum*, *R. velutinum*, *R. erythrocarpum* and the Oregon Caves variety of *R. sanguineum*. Some resistance was shown by *R. divaricatum* (open form), *R. lacustre*, *R. setosum*, *R. viscosissimum*, *R. laxiflorum*, *R. lobbii*, *R. acerifolium*, *R. americanum*, and cultivated red currants and gooseberries (unnamed).

554. Kimmey, J. W., and **Mielke, J. L. 1944.** Susceptibility to white pine blister rust of *Ribes cereum* and some other *Ribes* associated with sugar pine in California. *J. For.*, **42,** pp. 752-6. (Condensed from *Exp. Sta. Rec.*, **92,** pp. 383-4.)
The Sequoia form of *R. cereum* is tentatively rated as low in susceptibility

—though higher than the Lassen Park form, which in turn is somewhat more susceptible than the resistant forms of this species tested in Feather River Meadows and in British Columbia and Oregon. Both the Sequoia and Lassen Park forms can produce appreciable amounts of sporidia under favourable conditions for infection. *R. tularense* and *R. montigenum* are tentatively classed as medium in susceptibility and telium-production; *R. roezlii* is highly variable in northern California, its average susceptibility was lower and its telium-production much higher than previously reported on tests from plants transplanted in British Columbia, though some individuals tested were susceptible; its southern race is more susceptible than the northern one.

555. Kinman, C. F. 1948. Report of the committee on new fruits and nuts for 1947. *Proc. 62nd Convent. Amer. pomol. Soc.*, pp. 158-210.

Cascade red currant, originated by the University of Minnesota, is a seedling of Diploma. It is an early to mid-season variety, moderately susceptible to leaf spot.

September, originated by the N.Y. Agricultural Experiment Station, Geneva, from a cross between Marcy and Ranere, is an autumn-fruiting red raspberry. The fruit is firm and coherent but it tends to cling to the receptacle.

Tennessee Luscious, originated by the Tennessee Agricultural Experiment Station, Knoxville, from a cross between Lloyd George and Tennessee Seedling VVF169, is a later hardy type propagated by suckers and cuttings.

Vandyke, originated at Ontario Horticultural Experiment Station, Vineland, from Adams 57 · Viking, is almost spineless. It is rather susceptible to virus.

Klein, L. G. 1951a and b. *See* **Slate, G. L.,** and **Klein, L. G.**

Klein, L. G. 1952. *See* **Slate, G. L.,** and **Klein, L. G.**

Klein, L. G. 1954. *See* **Slate, G. L.,** and **Klein, L. G.**

556. Klesser, P. J. 1951. A virus disease of red currant (*Ribes rubrum* L.) *Ann. appl. Biol.*, **38**, pp. 707-13.

557. Knight, L. D. M. 1932. A contribution to the knowledge of the chemistry of raspberry varieties with special reference to its bearing on canning quality. *Rep. Long Ashton Res. Sta.*, pp. 32-46.

Large variations in chemical composition between varieties were found but these provided no obvious basis either for assessing canning qualities or for classifying the varieties into dessert or culinary groups. Taste was found to be an unreliable index of both acidity and content of total sugars.

Knight, R. C. 1925. *See* **Hatton, R. G., Grubb, N. H.,** and **Knight, R. C.**

Knight, R. C. 1927. *See* **Amos, J., Hatton, R. G., Knight, R. C.,** and **Massee, A. M.**

558. Knowles, D., Grottodden, O., and **Long, T. E. 1943.** Freezing preservation of North Dakota-grown raspberries. *Bi-m. Bull. N. Dak. agric. Exp. Sta.*, **5**, No. 5, pp. 17-19.

Cumberland, Latham, Early June and Chief are adapted to freezing when grown in North Dakota. Latham has a tendency to crumble when frozen; Ruddy retains good colour and flavour but crumbles badly.

559. Kobel, F. 1952. (A remarkable new raspberry variety.) *Schweiz. Z. Obst. u. Weinb.*, **61,** pp. 24-6.
Romy, an everbearing variety derived from Lloyd George, is described.

560. Kobel, F. 1955. (Plant breeding work.) *Schweiz. Landw. Z.*, **83,** pp. 1078-84. (Condensed from *Plant Breed. Abstr.*, **26,** p. 281.)
Raspberry: Two new varieties developed at Wädenswil are described. Andenken an Paul Camenzind gives high yields of attractive, good flavoured berries. It is adapted to light, well-ventilated acid soils but not to calcareous soils nor to conditions of excessive soil moisture. Rote Wädenswiler produces medium-sized berries of excellent flavour but is late in ripening.

Koch, E. C. 1951. *See* **Wilhelm, S., Thomas, H. E.,** and **Koch, E. C.**

561. Koch, L. W. 1931. Spur blight of raspberries in Ontario caused by *Didymella applanata. Phytopathology*, **21,** pp. 247-87.
This account of the disease includes a survey of susceptibility in 23 raspberry varieties: *Highly susceptible*—Brighton, Herbert, Idaho, Erskine Park. *Susceptible*—Adams 87 and 101, Cayuga, Cuthbert, Count, King, Latham, Marlboro, Owasco, Ohta, Seneca, St. Regis, Viking, *Rubus odoratus. Moderately resistant*—Columbian, Newman 23, Plum Farmer (blackcap), wild black raspberry. *Resistant*—Blackberry.

562. Kock, G. 1914. (Varietal resistance of the gooseberry against mildew and the effects of sulphur treatment therefore.) *Z. Landw. Versuchsw. Osten.*, **17,** pp. 634-7.
Of about 100 varieties of gooseberry tested, 16 proved susceptible to natural infection in the field by American gooseberry mildew, while 56 proved susceptible to sulphur damage, including Industry, Leveller, and Roaring Lion.

The following synonyms are given: Industry = Rote Triumphbeere; London Monstreuse = Rote Preisbeere; Migolez = Red Walnut; Octavius Brown = Dan's Mistake; Roaring Lion = Rote Preisbeere; Twigem Wonderful = Braunrote Riesenbeere; Bumper = Rockwood; Emerald = Smaragdbeere; Green Willow = Grüne Flaschenbeere; Green Yellow Seedling = Golden Lion; Jolly Angler = Grüne Riesenbeere; Lofty = Grüne Riesenbeere; Nettle Green = Dünnschalige; Smiling Beauty = Hellgrüne Samtbeere; Globe Yellow = Runde gelbe; Golden Yellow = Marmorierte Goldkugel; Hönings Früheste = Früheste gelbe.

The following synonyms are according to Maurer: Liberator = Broom Girl; Leveller = Gelbe Riesenbeere; Two to One = Riesenzitronenbeere; Yellow Lion = Früheste gelbe; Antagonist = Weisse Kaiserbeere; Large Hairy = Weisse Dünnschalige; Primrose = Weisse Kristallbeere; Queen Carolin = Snowball; Shanon = Weisse Volltragende; Whitesmith = Weisse Triumphbeere.

563. Kock, G. 1914. (The resistance of various gooseberry varieties against North American gooseberry mildew and their behaviour on treatment with sulphur.) *K. K. Pflanzensch., Vienna*, 4 pp. (From *Exp. Sta. Rec.*, **34,** p. 834.)

The author enumerates some 100 varieties of gooseberries under observation and gives further lists of those which were subject to mildew attack and those which suffer from leaf-fall upon being treated with sulphur.

564. Koehne, E. 1902. *Ribes grossularia×nigrum* (*R. schneideri* Maurer in litt.). *Gartenflora*, **51,** pp. 409-11.
A botanical description of this spineless, sterile hybrid, which occasionally sets parthenocarpic fruits.

565. Kondrat'eva, M. N. 1939. (New varieties of gooseberry.) *Sadovodstvo* (Horticulture), No. 12, p. 42. (From *Plant Breed. Abstr.*, **10,** p. 237.)
New varieties resistant to *Sphaerotheca*, rust and frost are described.

566. Kostina, V. N. 1938. (The best raspberry hybrids at the Mleev Experiment Station.) *Plodoovoščnoe Khozaistvo* (Fruit and Veg. Gr.), No. 4, pp. 62-3. (From *Plant Breed. Abstr.*, **9**, p. 118.)
The aims and methods of raspberry breeding at the Mleev Experiment Station are outlined and the best hybrids described.

567. Kostina, V. N. 1938. (The hybrid stock of gooseberries at the Mleev Experiment Station.) *Plodoovoščnoe Khozaistvo* (Fruit and Veg. Gr.), No. 4, pp. 60-2. (From *Plant Breed. Abstr.*, **9,** p. 118.)
On the basis of observations of a large number of crosses, indications are given of the most promising combinations in respect of such qualities as resistance to *Sphaerotheca* (many of the most resistant being hybrids of gooseberry · currant), spinelessness, and form of bush. The best hybrids have berries 2-3 times the size of those of Houghton.

568. Kozlov, K. 1950. (Introducing *Rubus arcticus* to horticulture.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 1, p. 72.

569. Kramer, O. 1923. Observations upon the date of fruit bud formation in various fruits. *Dtsch. ObstbZtg.*, **69,** No. 29, pp. 224-7.
Data are presented on the time of fruit bud differentiation in 1922 for numerous fruits including varieties of currants and gooseberries.

570. Kronenberg, H. G., and **Nannenga, E. T. 1949.** (The raspberry varieties Ir Leendertz and Verbeterde Preussen.) *Fruitteelt*, **39,** p. 250. (From *Plant Breed. Abstr.*, **19,** p. 881.)
Ir Leendertz, Verbeterde Preussen and Deutschland are synonyms for a selection from Preussen and should be referred to as Deutschland.

571. Kronenberg, H. G., and **de Fluiter, H. J. 1951.** (Resistance of raspberries to the large raspberry aphid (*Amphorophora rubi* Kalt.) *Tijdschr. PlZiekt.*, **57,** pp. 114-23. (From *Plant Breed. Abstr.*, **22,** p. 286.)
In field observations on resistance to *Amphorophora rubi* in varieties of raspberries at the Institute for Horticultural Plant Breeding, Wageningen, practically no aphids were found on Malling Landmark and Milton [actually September, personal communication], few on Indian Summer, Newburgh and Viking, while most of the other varieties were infested. Tests with potted shoots confirmed the resistance of Malling Landmark and Milton [September], but also showed that some of the varieties

relatively resistant in the field were not resistant under all conditions, so that field infestation should not be used as a reliable basis for selection. Resistance is hereditary, and the highest percentage (49%) of resistant seedlings was obtained from Milton [September] × Newburgh and from Milton [September] × Viking. It should be noted that aphids that do not develop on the green foliage of resistant plants may thrive on old yellow leaves of such plants.

572. Kronenberg, H. G. 1952. (In which respects is breeding in soft fruits desirable and possible?) (General plant breeding meeting 1951.) *Meded. Inst. Vered. TuinbGewass.*, No. **32,** pp. 59-79.
Tabulated data for a number of varieties of raspberries, currants, and gooseberries are included.

573. Kronenberg, H. G. 1953. (Small fruit breeding in the U.S.A.) *Meded. Dir. Tuinb.*, **16,** pp. 39-52, 105-13.

574. Kronenberg, H. G., and **Doesburg, J. J. 1955.** (The vitamin C content of black currant varieties requires more attention!) *Fruitteelt*, **45,** p. 869.
Baldwin, followed by Daniel's September and Akkerman's currant, had the highest vitamin C content; Goliath was extremely poor.

575. Kuminov, E. 1953. (New varieties of raspberry.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 8, p. 67. (Condensed from *Plant Breed. Abstr.*, **24,** p. 118.)
Sladkaja and Zorjka are described. The former derives from open pollinated Usanka and the latter from open pollinated Marlboro.

576. Kuminov, E. P. 1955. (A new gooseberry variety in Siberia.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 9, pp. 76-7.
Pervenec from Mestnyĭ Altaĭskiĭ × Zelenyĭ Butyločnyĭ is hardy and resistant to *Sphaerotheca.*

577. Kuzmin, A. J. 1937. (Results of inter-subgeneric hybridization in the genus *Ribes.*) (Horticulture by Michurin's methods.) *Bull. Lenin Acad. Agric. Sci. Res. Inst. Fruit Grow. I. V. Michurin*), Nos. 5-6, pp. 41-50. (Condensed from *Plant Breed. Abstr.*, **10,** p. 140.)
The hybrid *Ribes nigrum* × *R. dikuscha* when pollinated with gooseberry gave 98 hybrid plants all of which were intermediate in leaf form and bore short spines. Nine were immune to *Sphaerotheca*, 28 were resistant and 61 susceptible. All were attacked by mildew. The number of flowers per inflorescence varied from one to five in different hybrids. The fruits were small with seed resembling gooseberry seeds. One hybrid had fruits reminiscent of a gooseberry.

The hybrid Kazyrgan (*R. rubrum* × *R. petraeum*) was successfully crossed with black currant, gooseberry, *R. odoratum*, and with the *R. nigrum* × *R. dikuscha* hybrid—it is regarded as a bridging species. In hybrids between the sections *Ribesia* and *Coreosma* the characters of the black currant are mainly dominant except for the aroma of leaves and stem.

578. Kuzmin, A. J. 1938. (Some results of interspecific hybridization in *Ribes*, *Rubus* and *Fragaria.*) *Bull. Acad. Sci. U.R.S.S., Ser. Biol.*, pp. 681-92. (Condensed from *Plant Breed. Abstr.*, **9,** pp. 342-3.)

By pollinating the first formed flowers of a seedling of *Ribes nigrum* var. *pauciflorum* Jancz. with a mixture of pollen of *Grossularia reclinata*, *G. succirubra* and other species, a hybrid was obtained from which one weak F_2 plant was raised.

The first flowers of a hybrid *Ribes nigrum* × *R. dikuscha* Fisch. pollinated by the gooseberry Zelenyĭ Butyločnyĭ produced 98 hybrid plants. These were pollinated with a mixture of pollen from a number of varieties of black currant and gooseberry, and 22 normal berries, mostly containing normal seed, were obtained. The berries were equal in size to black currants, some were slightly larger; in flavour they were reminiscent of both parents. The plants nearly all bore spines, 9 of them were immune to *Sphaerotheca mors-uvae*. One spineless seedling occurred.

Kazyrgan red currant was obtained by Michurin from *R. rubrum* × *R. petraeum*. Kazyrgan was successfully crossed with *R. nigrum*, mixed pollen of different black currant varieties giving the best results. The black currant and the hybrid *R. nigrum* × *R. dikuscha* when pollinated by Kazyrgan produced a good set of seed; Kazyrgan was also crossed with *R. odoratum*. The following numbers of plants were obtained in these different combinations: *Ribesia* × *Coreosma* 168 plants, *Coreosma* × *Ribesia* 128, *Coreosma* × *Grossularia* 1,332, *Grossularia* × *Coreosma* 3, and *Ribesia* × *Grossularia* 1. In the black × red currant hybrids the black currant characters are mostly dominant, except the characteristic odour.

In *Rubus*, Michurin's Texas (a selected hexaploid loganberry seedling) was crossed with diploid *R. idaeus*, producing several seedlings. The Texas raspberry (2n=42) pollinated by Marlboro (2n=14) gave one fertile plant with 2n=35, resulting from fertilization by an unreduced pollen grain. From crosses of the raspberry Usanka (2n=14) × Texas a hybrid with 2n=28 was obtained, and by pollinating the triploid raspberry Orekhovka (*R. idaeus*, 2n=21) by the hexaploid *R. ursinus* (2n=42), seven fertile hybrids of raspberry type were formed from unreduced gametes of the triploid; one of them was exceedingly fertile and is considered promising.

579. Kuzmin, A. J. 1940. (The role of the intermediary plant in obtaining the first and second generation between black currant and gooseberry.) *Proc. Lenin Acad. Sci. U.S.S.R.* No. 5, pp. 3-12. (Condensed from *Plant Breed. Abstr.*, **10**, p. 307.)

Hybrids between black currant (*Ribes nigrum*) and gooseberry (*Grossularia reclinata*) are usually sterile. The first flowers of the hybrid *R. nigrum* × *R. dikuscha* were pollinated with the gooseberry Zelenyĭ Butyločnyĭ (Green Bottle). The hybrids so obtained were vigorous and formed numerous large flowers. These were pollinated with mixed black currant and gooseberry pollen giving 22 berries from the nine hybrids. The berries were small like black currants and intermediate in flavour; some were seedless. From 22 seeds only 1 plant was obtained. This had elongated buds, very vigorous growth and the black currant scent.

580. Kuzmin, A. J. 1941. (Hybrid of raspberry and blackberry.) *Vestnik Gibridizacii* (Hybridization), No. 1, pp. 116-18. (Condensed from *Plant Breed. Abstr.*, **12**, p. 278.)

The cross was much more successful when the raspberry was the maternal parent, giving a set of up to 41·7%. Out of 820 seeds from the cross Orekhovka raspberry (2n=21) × Prolific blackberry (2n=42), however, only 11 mature seedlings were obtained; these had chromosome numbers

ranging from 35 to 42 and varied in fertility. Two large-fruited seedlings with high fertility were selected. Of these one failed to survive the winter, the other gave a good yield of large fruit, free from the hard seeds associated with blackberries and producing excellent jam. Seed from open pollination of the hybrid has given winter-hardy seedlings.

581. Kuzmin, A. J. 1941. (The role of the intermediary in hybridizing currants with gooseberries.) *Sovetskaja Botanika* (Soviet Botany), No. 1-2, pp. 14-23. (Condensed from *Plant Breed. Abstr.*, **13,** pp. 362-3.)

Forty hybrids were obtained in 1933 by pollinating seedlings of Siberian black currant with mixed gooseberry pollen. The hybrids were vigorous, spineless and resistant to mildew. The first fruits, borne in 1936, yielded three seeds and these gave one rather weak seedling; in 1937, 26 fruits were obtained from which one further seedling was raised.

The first formed flowers of an F_2 seedling of *Ribes nigrum* × *R. dikuscha* were pollinated with gooseberry pollen of the variety Zelenyĭ Butyločnyĭ (Green Bottle). A 59% set was obtained compared with 18% when the same pollen was used on the first flowers of an *R. nigrum* seedling. The following year these two crosses were repeated and gave 13·4% and 13·6% respectively, the set becoming progressively less as the bushes became older.

The red currant Kazyrgan, a hybrid between the series *Rubra* and *Petraea*, was crossed with various black currants and gooseberries. The red currant × gooseberry hybrids flowered in the second or third year and were pollinated with mixed black currant and gooseberry pollen. Twenty-two fruits were obtained from nine hybrids, they were about the size of a black currant and intermediate in flavour.

The red currant × black currant hybrids flowered in their third year—one hybrid plant was raised as a result of pollinating them with mixed black and red currant pollen.

It is noted that I. A. Tolmačev produced fertile hybrids by crossing Kazyrgan with gooseberry and with black currant. One seedling from the latter cross bore abundant fruits in clusters up to 25 cm. long; the fruits were somewhat larger than black currant and contained normally developed seeds.

582. Kuzmin, A. J. 1948. (The effect of the age of flower upon the compatibility of distant plant species.) *Doklady Akad. Nauk S.S.S.R.* (Proc. Acad. Sci. U.S.S.R.), **59,** pp. 333-5. (Condensed from *Plant Breed. Abstr.*, **27,** p. 359.)

Hybrids of Kazyrgan red currant × Davison's Eight black currant are characterized by uniform maturation, large berries of even size, hardiness and resistance to running off and *Pseudopeziza*. The selected F_2 plants produce higher quality berries than Davison's Eight and other standard varieties of black currant.

583. Kuzmin, A. J. 1951. Suppressed inheritance in distant hybridization of plants. *Doklady Akad. Selskohozjaistv. Nauk Lenin* (Proc. Lenin Acad. Agric. Sci.), No. 6, pp. 18-21. (Condensed from *Plant Breed. Abstr.*, **22,** pp. 287-8.)

Suppression of female inheritance in some hybrids was achieved by allowing an interval of several days between emasculation and fertilization of the flowers. By this time the female organs had passed through their

mature stage and the egg cells had lost their selective capacity for foreign pollen.

The material studied included hybrids between the red currant Kazyrgan ♀ and the black currant Davison's Eight ♂. Most hybrids resembled the male parent but produced solitary, small, dark red, glossy fruits containing a single seed which resembled the seed of the female parent.

Other hybrids produced large and small black fruits with a waxy bloom. These fruits contained 2-6 seeds each resembling those of the male parents. The fruits of the hybrids were larger than those of the standard Lija Plodorodnaja (Productive Lia). For instance, the 100 fruit weight of triploid seedling 5/37 was 59·6 g. After open pollination in 1947, 1949 and 1950, hybrid 5/37 gave viable seed, which was planted in the open. All the second generation progenies showed the properties of the P_1 male parent. Several F_2 hybrids produced good quality fruits with a higher sugar content than the initial varieties and the standard Lija Plodorodnaja.

Kvåle, E. 1947. *See* **Brantsegg, O., and Kvåle, E.**

584. Lachmund, H. G. 1926. Studies of white pine blister rust in the West. *J. For.*, **24**, pp. 874-84. (Condensed from *Rev. appl. Mycol.*, **6**, pp. 386-7.)

A popular account of white pine blister rust (*Cronartium ribicola*), summarizing published results of investigations in Europe and N. America. The red flowering currant (*Ribes sanguineum*), squaw currant (*R. cereum*), gummy gooseberry (*Grossularia lobbii*), and coast black gooseberry (*G. divaricata*) are congenial hosts for the rust, the first two species being particularly susceptible.

Lachmund, H. G. 1937. *See* **Mielke, J. L., Childs, T. W., and Lachmund, H. G.**

585. La Cour, L. F. 1954. Cytology department. *Rep. John Innes hort. Instn for 1953*, pp. 18-20.

The tetraploid Veitchberry (BBRR) when crossed with raspberries gives sexual hybrids and, in addition, diploid raspberries, blackberries and raspberry-blackberry hybrids. It is male sterile, but when bagged and not pollinated it produces seed which gives tetraploid Veitchberry plants. The ability of the Veitchberry to behave as an apomict is dependent on a delicate environmental balance. In some years no seeds are produced apomictically while in others they may be abundant.

586. Lamb, R. C. 1948. Effect of temperatures above and below freezing on the breaking of rest in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **51**, pp. 313-15.

Rest is broken more rapidly by temperatures between 45 and 32° F. than at sub-freezing temperatures. The retarding effect of sub-freezing temperatures appears to be due to initial shock, since continued exposure to sub-freezing temperatures breaks rest rapidly.

Landon, R. H. 1946. *See* **Brierley, W. G., and Landon, R. H. 1946a and b.**

Landon, R. H. 1952. *See* **Brierley, W. G., Landon, R. H., and Stadtherr, R. J.**

587. Lantz, H. L. 1948. Black cap raspberries: breeding to produce varieties resistant to anthracnose. *Trans. Ia hort. Soc.*, **83**, pp. 94-100. (Condensed from *Plant Breed. Abstr.*, **20**, p. 564.)
The breeding of black cap raspberries at the Iowa Agricultural Experiment Station since 1928 is reviewed. Seedlings have been obtained which show satisfactory resistance or tolerance to anthracnose.

Latimer, L. P. 1945. *See* **Yeager, A. F., Latimer, L. P.,** and **Eggert, R.**

Latzke, E. 1933. *See* **Yeager, A. F.,** and **Latzke, E.**

Lawrence, W. J. C. 1931. *See* **Crane, M. B.,** and **Lawrence, W. J. C.**

Lawrence, W. J. C. 1952. *See* **Crane, M. B.,** and **Lawrence, W. J. C.**

588. Laxton, T. 1874. Autumn-bearing raspberry. *Gdnrs' Chron., N.S.*, **2**, p. 466.

589. Ledeboer, M., and **Rietsema, I. 1937.** A case of unfruitfulness in black currants. *J. Pomol.*, **15**, pp. 191-204.
Lee's, a continental variety not to be confused with Lee's Prolific, does not set fruit in the absence of foreign pollen. Its pollen and ovules appear normal and its pollen tubes reach the ovary successfully but either fail to penetrate the ovule or else there is a failure of the fusion of the male and female nuclei.

590. Ledeboer, M., and **Rietsema, I. 1940.** Unfruitfulness in black currants. *J. Pomol.*, **18**, pp. 177-81.
Self-sterility in Lee's was caused by lack of fusion between the male and female gametes. Poor pollen tube growth was not responsible. Fruit develops only when ovaries contain four or more embryos.

591. Ledin, R. B. 1955. Sub-tropical crops of minor economic importance. *Rep. Univ. Fla agric. Exp. Stas for year ending June 30, 1955*, p. 307.
Reports the fruiting of over 500 plants from open-pollinated seed of F_1 hybrids between *Rubus albescens* Lam. and Latham, Sunrise, and Taylor red raspberries. Backcross seedlings of the F_1 and F_2 hybrids to Latham and Sunrise have been planted, as have hybrids of *R. albescens* with black raspberry varieties.

592. Lee, F. A., and **Slate, G. L. 1954.** Chemical composition and freezing adaptability of raspberries. *Bull. N.Y. St. agric. Exp. Sta.*, **761**, 12 pp.
Varieties which freeze well are usually higher in ascorbic acid, soluble solids, and free acid, and lower in pH. For freezing preservation Willamette, Milton, Taylor, and Newburgh were the best reds, Bristol was the most satisfactory black, Sodus and Marion were the best purples and Amber the best yellow. Red raspberries have more ascorbic acid than blacks and purples. Dundee and Morrison had over twice the colour density of Bristol among the black raspberries, and Sodus and Marion over twice that for Columbian among the purple varieties. This is important in jam and jelly manufacture.

593. Lees, A. H. 1918. 'Reversion' and resistance to 'big bud' in black currants. *Ann. appl. Biol.*, **5,** pp. 11-27.
The mite resistance shown by Seabrook's Black is due to the mite killing the attacked growing point and thus starving itself.

594. Lees, A. H. 1925. Reversion disease of black currants: means of identification. *Ann. appl. Biol.*, **12,** pp. 199-210.

Lefevre, V. 1859. *See* **Mueller, P. J.,** and **Lefevre, V.**

595. Lepik, E. 1937. (Pine rusts and their distribution.) *Eesti Metsand. Aastar.*, **8,** pp. 177-96.
In addition to black, white, and red currants and gooseberries, *Cronartium ribicola* attacks *Ribes alpinum*, *R. aureum*, *R. palmatum*, and *R. sanguineum*.

596. Lewis, D. 1939. Differential fertilization in *Rubus idaeus* L. *J. Genet.*, **37,** Appendix p. 3.
The gene w, which inhibits or retards pollen tube growth, is linked to T/t (fruit colour) and to G/g (chlorophyll deficiency), the order being apparently TGW. The differential effect of w on pollen tube growth may depend on the genetic constitution of the stylar tissue.

597. Lewis, D. 1939. Genetical studies in cultivated raspberries. I. Inheritance and linkage. *J. Genet.*, **38,** pp. 367-79.
Five new genes are described, viz. s, spineless shoots; b, shoots without waxy bloom; x, red hypocotyl; g, pale green leaf; and d, sepaloid flowers. Spined plants have stalked glands on cotyledons and young leaves, spineless plants are devoid of them. Additional data are summarized on the genes established by Crane and Lawrence (1931). Statistical analysis of all gene segregations showed significant heterogeneity in the segregation of the linked genes T and G when the male parent was heterozygous, but not when the female only was heterozygous. Segregation of all other genes was homogeneous. The proportion of hairy, H, to subglabrous, h, individuals exhibits a significant deficiency of hairy plants when a 3: 1 ratio is expected but not with a 1: 1 expectation. Instead of a 3: 1 ratio there is a good fit to a 2: 1 and additional evidence supports the conclusion of Crane and Lawrence (1931) that HH forms are partly suppressed by a tightly linked lethal.

The genes T (red fruit and spines), B (waxy bloom on stem), G (green leaf) and X (green hypocotyl) form one linkage group.

Sepaloidy is not inherited simply, for there is considerable variation in this phenotype, although one basic recessive gene is chiefly responsible.

598. Lewis, D. 1940. Genetical studies in cultivated raspberries. II. Selective fertilization. *Genetics*, **25,** pp. 278-86.
A gene w causing differential fertilization in the cultivated raspberry is described. It causes aberrant ratios and heterogeneity in linked marker genes T and G when the particular genes are segregating on the male side.

The gene w acts by inhibiting pollen tube growth. Crossover values between W and T and G are calculated and a chromosome map of the linkage group BTGXW is given [see Appendix II].

599. Lewis, D. 1941. The relationship betwe n polyploidy and fruiting habit in the cultivated raspberry. *Proc. 7th int. genet. Congr., Edinb., August 1939*, p. 190.

Summer fruiting raspberries bear their main crop on the canes formed in the previous year; autumn fruiting types produce their main crop on the current season's growth. The former are all diploids (2n=14), the latter, with rare exceptions, are polyploids (2n=21 or 2n=28). The autumn fruiting habit is not a direct expression of polyploidy—it is occasionally found in diploids, and eight triploids which arose under controlled conditions were not autumn fruiting in habit. Breeding experiments indicate that autumn fruiting is due to a recessive gene.

It is considered that there has been rigorous natural selection favouring autumn fruiting in tetraploids—those which are not autumn fruiting being largely pollinated by diploids giving triploid progeny.

600. Lewis, D. 1946. Growing raspberry crops from seed. *Monthly Sci. News*, No. 2, p. 54.

This brief popular account suggests the following advantages for the method:

1. Virus is not seed transmitted, so that healthy stocks are automatically produced.
2. Plants in family differ in their reaction to virus; this retards virus spread.

The hybrid seed could be produced by crossing established varieties or selected seedlings and this should give plants ready for planting out in May; a crop can be picked the following summer. First and second crops are heavier than from vegetatively propagated varieties.

The disadvantage is the lack of sufficient uniformity for commercial crop.

601. Ley, A. 1902. Two fresh *Rubus* forms. *J. Bot., Lond.*, **40**, pp. 69-70.

602. Lidforss, B. 1905. (Studies on speciation in the genus *Rubus*. I.) *Ark. Bot.*, **4**, pp. 1-41.

603. Lidforss, B. 1907. (Studies on speciation in the genus *Rubus*. II.) *Ark. Bot.*, **6**, pp. 1-43.

604. Lidforss, B. 1914. (Résumé of investigations in the genus *Rubus*.) *Z. indukt. Abstamm.- u. VererbLehre*, **12**, pp. 1-13.

A posthumous manuscript presented by W. Johannsen and dealing with hybridization experiments in *Rubus*.

Linton, E. F. 1905. *See* **Rogers, W. M.**, and **Linton, E. F.**

605. Lisavenko, M. A. 1940. (On the path of Mičurin.) *Jarovizacija*, No. 3 (30), pp. 180-1. (Condensed from *Plant Breed. Abstr.*, **11**, p. 225.)

The raspberry Visluha, selected in 1935, is very frost resistant. The gooseberry Mičurinets is resistant to *Sphaerotheca*.

606. Lisavenko, M. A. 1950. (To continued progress in Siberian horticulture.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 1, pp. 3-11. (Condensed from *Plant Breed. Abstr.*, **21**, p. 408.)

The raspberry variety Visluha (Drooping) is more resistant to drought than Novostj Kuzjmina (Kuz'min's Novelty).

607. Lisavenko, M. A. 1952. (Fasciation in the black currant.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 6, pp. 30-3. (From *Plant Breed. Abstr.*, **23,** p. 131.)
Stahanovka Altaja, bred at the Altaĭ Horticultural Research Station from Goliath × Čempion Primorjja (Primorsk Champion), developed coalescent fruits when grown in the Altaĭ and the Leningrad province. Fasciation, which had been observed earlier in Goliath, is regarded as a symptom of shattered inheritance and of imminent qualitative changes. Breeding black currants for large size by fixing the character of coalescent fruits is advocated.

Long, T. E. 1943. *See* **Knowles, D., Grottodden, O.,** and **Long, T. E.**

608. Longley, A. E. 1923. Cytological studies in the genera *Rubus* and *Crataegus*. *Amer. Nat.*, **57,** pp. 568-9.
Substantially the same data on *Rubus* are presented as under Longley, 1924.

609. Longley, A. E. 1924. Cytological studies in the genus *Rubus*. *Amer. J. Bot.*, **11,** pp. 249-82.
The *Rubi* ($x=7$) are divided into (*a*) diploid species and (*b*) polyploid species including triploid, tetraploid, pentaploid, hexaploid and octoploid. The diploid species are characterized by regular meiosis and pollen formation and are regarded as pure species. The polyploids show striking irregularities in meiosis and pollen formation, leading frequently to polycary and polyspory. This group is regarded as comprising hybrid species and forms, some of which may date from pre-glacial times, but many of the so-called species may be of contemporary hybrid origin.

610. Longley, A. E., and **Darrow, G. M. 1924.** Cytological studies of diploid and polyploid forms of raspberries. *J. agric. Res.*, **27,** pp. 737-48.
Diploid species and hybrids are the rule in the *Idaeobati*. Triploid and tetraploid forms are few but form a significant and characteristic group of raspberries. It is suggested that polyploidy in raspberries has originated through hybridization and that polyploid raspberries are *Idaeobatus* × *Eubatus* hybrids. The Nessberry is an example of such spontaneous tetraploidy.

611. Longley, A. E. 1927. Relationship of polyploidy to pollen sterility in the genera *Rubus* and *Fragaria*. *Mem. hort. Soc. N.Y.*, **3,** pp. 15-17.

Longley, A. E. 1933. *See* **Darrow, G. M.,** and **Longley, A. E.**

612. Loree, R. E. 1933. The Viking raspberry. *Quart. Bull. Mich. agric. Exp. Sta.*, **16,** pp. 99-100.
Viking arose from the cross Cuthbert × Marlboro.

613. Lorenz, P. 1929. (Hybridization in the genus *Ribes*.) *Züchter*, **1,** pp. 66-8. (From *Exp. Sta. Rec.*, **61,** p. 429.)
In crosses between mildew resistant American types (e.g. the American mountain gooseberry, *R. oxyacanthoides*, *R. divaricatum*, and *R. pinetorum*) and mildew susceptible European forms all the F_1 plants were susceptible, while in the F_2 some highly resistant forms appeared. Resistance is considered to be tri-factorial and recessive, about 1 in every 60 of the

F_2 plants being resistant. Gooseberry varieties classed as fairly resistant are: Grüne Riesen (Green Giant), Rote Triumph, Beste Grüne, and May Duke.

Growth types occurring in the F_2 ranged from normal bushes to creeping dwarf forms often with malformed leaves. Some very vigorous F_2 hybrids deemed of use as rootstocks for high-stemmed gooseberries appeared in a *R. divaricatum* × *R. oxyacanthoides* cross. The existence of thornless gooseberries, such as Souvenir de Billard, and of various slightly thorned forms, suggests that thorniness is determined by a series of similar genes. In any large F_2 generation there always occurred some more or less thornless seedlings. Combined thornlessness and good quality are believed a possible attainment.

Sterility was encountered in the F_1s of a series of crosses between *R. nigrum* and various European and American species, and even though from 20 to 30% of the pollen appeared normal, backcrosses were unsuccessful.

Seed has been obtained from the following crosses: *R. sanguineum* × *R. grossularia* (failed to germinate); *R. nigrum* × *R. aureum* (failed to germinate, except one seedling which died in the cotyledon stage); *R. alpinum* ♀ × *R. rubrum; R. alpinum* ♀ × *R. sanguineum; R. alpinum* ♀ × *R. grossularia;* Gooseberry × *R. irriguum*, × *R. succirubrum*, × *R. gracile*, × *R. oxyacanthoides*, and × *R. rubrum.*

614. Lott, R. V. 1931. An important varietal characteristic of the red raspberry. *Proc. Amer. Soc. hort. Sci.*, **27**, pp. 139-41.

Bud distribution appears to be a varietal characteristic. For Northern Colorado it is most desirable to have a large number of buds in the third, fourth and fifth foot, this being the region of the greatest yield per bud. Of the varieties tested, June had the greatest bud concentration in this zone and Cuthbert the least, Cayuga, Latham and Lloyd George being intermediate.

615. Lott, R. V. 1931. Raspberry investigations. A preliminary study of the fruiting habit of the red raspberry—*Rubus strigosus. Bull. Colo agric. Exp. Sta.*, **367**, p. 41.

616. Luckan, —. 1935. (Raspberry cane disease.) *VerbMitt. Landesverb. Sachsen Obstb.*, **7**, p. 105. (From *Rev. appl. Mycol.*, **14**, p. 775.)

The increasing susceptibility to *Didymella applanata* of the reputedly resistant Preussen raspberry has greatly reduced the value of this variety for cultivation in Saxony. F_1 hybrids between raspberry and blackberry have shown resistance to *D. applanata.*

617. Luckwill, L. C. 1948. A note on the unfruitfulness of a rogue strain of the black currant variety 'Invincible Giant Prolific'. *Rep. Long Ashton Res. Sta.*, pp. 22-5.

Unfruitfulness in the rogue strain was due to failure of fertilization, although the pollen tubes reached the ovules.

618. Luckwill, L. C. 1955. Fruit drop in black currants. II. The effect of naphthalene acetic acid. *Rep. Long Ashton Res. Sta.*, pp. 75-7.

Naphthalene acetic acid applied at 10 p.p.m. to Seabrook's Black and Westwick Choice, either at flower bud or just prior to early drop, tended to increase fruit drop, and both sprays increased pre-harvest drop.

Luckwill, L. C. 1955. *See* **Teaotia, S. S., and Luckwill, L. C.**

Lund, W. T. 1934. *See* **Zeller, S. M., and Lund, W. T.**

619. MacDaniels, L. H. 1922. Fruit bud formation in *Rubus* and *Ribes*. *Proc. Amer. Soc. hort. Sci.*, **19,** pp. 194-200.
Fruit bud differentiation in Cumberland black raspberry began on about October 6; by January 11 flowers were well differentiated. Fruit bud differentiation in the red raspberry Herbert was considerably later.

In the Snyder blackberry, the flowers were clearly developed on September 16, by October 15 the receptacle of the terminal flower was corrugated with young pistils and remained at this stage until March.

Gooseberry growing points differentiated into flowers about the first week of August, and red currant differentiated in late July or early August.

620. MacFarlane, J. M. 1892. A comparison of the minute structure of plant hybrids with that of their parents and its bearing on biological problems. *Trans. roy. Soc. Edinb.*, **37,** pp. 203-86.
Includes a description of Culverwell's black currant-gooseberry hybrids.

621. MacFarlane, J. M. 1900. Hybrid *Ribes*. *Gdnrs' Chron.*, **28,** Ser. 3, p. 7.
In *R. culverwellii*, glandular hairs occur which are similar to, though smaller than, those of the black currant.

Macherauch, O. 1926. *See* **Hönings, J., and Macherauch, O.**

622. Macoun, W. T. 1907. Bush fruits. *Bull. Cent. exp. Fm Canada*, **56,** 67 pp. (Condensed from *Exp. Sta. Rec.*, **19,** p. 340.)
Deals with the history, cultivation, varieties, and pests of currant, gooseberry, raspberry and blackberry. Descriptions are given of the most promising varieties, including 45 varieties of currants, gooseberries and raspberries originated by W. Saunders. The work concludes with an historical sketch of the work of Saunders in improving bush fruits.

623. Macoun, W. T. 1923. *Report of the Dominion Horticulturist for 1922*. Dep. Agric. Canada, 42 pp.
Attempts to breed a thornless gooseberry with desirable fruit were unsuccessful, the thornless character being apparently recessive.

624. Macoun, W. T., *et al.* 1926. *Report of the Dominion Horticulturist for 1925*. Dep. Agric. Canada, 51 pp.
F_1 seedlings of loganberry × raspberry were sterile. Seedlings from crosses between red and purple raspberries were exceedingly vigorous and differed widely in colour of fruit and method of vegetative propagation. A spineless gooseberry bearing good sized fruit has been bred.

Magnel, L. 1928. *See* **Charlet, A., Magnel, L., and Maréchal, A.**

Maloit, J. C. 1945. *See* **Bohn, G. W., and Maloit, J. C.**

Maney, T. J. 1934. *See* **Stoutemyer, V. T., Maney, T. J., and Pickett, B. S.**

Maréchal, A. 1928. *See* **Charlet, A., Magnel, L., and Maréchal, A.**

625. Markham, E. 1936. Raspberries and kindred fruits. Macmillan & Co. Ltd., London, 68 pp.

626. Marsh, R. W., and **Maynard, J. G. 1928.** A preliminary note on the control of black currant leaf spot (*Pseudopeziza ribis*). *Rep. Long Ashton Res. Sta.*, pp. 109-11.
The bulk of this paper deals with control by spraying. The severity of attack was greater on Baldwin than on French, Victoria, Boskoop, September Black, The Brodie, Blacksmith, Black Grape, and Edina, which either developed the disease very slightly or not at all.

627. Marth, P. C., and **Meader, E. M. 1944.** Influence of growth-regulating chemicals on blackberry fruit development. *Proc. Amer. Soc. hort. Sci.*, **45,** pp. 293-9.

628. Martin, H. 1930. The defoliation of gooseberries by sulphur-containing sprays. *J. S.-E. agric. Coll. Wye, No. 27,* pp. 182-5.
A study was made of the susceptibility of Leveller to defoliation when sprayed with lime-sulphur and colloidal sulphur sprays. The results suggest that elementary sulphur (and not soluble sulphides) is responsible.

629. Massee, A. M. 1924. The leaf and bud mite of raspberry (*Eriophyes gracilis* Nal.). *J. Pomol.*, **4,** pp. 59-61.
The description and life history of this mite are given. It has been found on Baumforth B, Hornet B, Superlative, Profusion, Devon, Norwich Wonder, Red Cross, Baumforth A, Semper Fidelis, Bountiful, Norwich Market, Penwill's Champion and Helston, but Hornet B was attacked to a greater extent than any other variety.

Massee, A. M. 1924. *See* **Grubb, N. H.,** and **Massee, A. M.**

630. Massee, A. M. 1927. Observations on the presence of mites (*Eriophyes ribis*) upon black currant bushes manifesting reversion and big bud. *Rep. E. Malling Res. Sta. for 1925, Suppl.*, pp. 151-3.
Black Naples, Prince of Wales, Champion, Blacksmith, and Goliath all showed extreme symptoms of reversion, but after three growing seasons little big bud was present. Spurious 'big buds' appeared to be a common varietal characteristic of the Goliath group.

Massee, A. M. 1927. *See* **Amos, J., Hatton, R. G.,** and **Massee, A. M.**

631. Massee, A. M. 1952. Transmission of reversion of black currants. *Rep. E. Malling Res. Sta. for 1951*, pp. 162-5.
Phytoptus (*Eriophyes*) *ribis* (Westw.) Nalepa was proved to be the vector of reversion; the black currant capsid, *Lygus pabulinus* L., and four species of currant aphid failed to transmit the disease.

632. Massee, A. M. 1954. The pests of fruits and hops. Crosby Lockwood & Son Ltd., London, 3rd edn., 325 pp.

633. Mathers, B. A. 1952. A study of fruit-bud development in *Rubus idaeus*. *J. hort. Sci.*, **27,** pp. 266-72.
Fruit bud development was investigated in Lloyd George, Promise, and Landmark during the period 1949-51.

Floral differentiation begins in mid September, development following a definite gradient in the upper third of the cane (15 buds), maximum development being in buds 5-10. All records were made after pruning and the buds were counted from the top of the cane downwards.

The inflorescence is formed in definite stages, the first formed flower being terminal and developing most quickly. Later ones are formed basipetally in an irregular spiral and these develop more slowly. The mature inflorescence has 7-8 flowers, the top 3 or 4 being the best developed at the green-bud stage.

Torus, sepals and stamen rudiments are initiated before winter sets in, but further development is delayed until spring. Meiosis in anthers occurs during the third week in April, and about four weeks later in the gynoecium.

Development of the bud slows down in the beginning of November but as buds can be forced after mid December, it seems the period of true dormancy (if it exists) is short. There is no note of any distinction between the varieties in time of commencement of flower initiation, although Landmark is stated to show less definite zoning in development and there was a less marked halt during November in this variety.

634. Matveeva, E. 1939. (New varieties of raspberry for the northern zone.) *Sadovodstvo* (Horticulture), *Moscow*, No. 12, pp. 39-40.

635. Mauk, H. P. 1925. (Control of American gooseberry mildew.) *Dtsch. ObstbZtg*, **71** (7), p. 81. (Condensed from *Rev. appl. Mycol.*, **4**, p. 357.)

The writer has observed no case of infection in the American Mountain Seedling variety, while Whinham's Industry, Roaring Lion, Wilmot's Early Red, Green Willow, Whitesmith and others are said to be resistant.

636. Mayer, A. 1931. (Diagnoses of new *Rubus* hybrids and subspecies.) *Denkschr. bayer. bot. Ges.*, **18**, pp. 129-60. (From *Plant Breed. Abstr.*, **3**, p. 34.)

Diagnoses are given for a number of subspecies and hybrids of *Rubus* occurring in the neighbourhood of Ratisbon, together with a species new for Germany, *R. mercieri* Genevier.

Maynard, J. G. 1928. *See* **Marsh, R. W.,** and **Maynard, J. G.**

637. Mayor, E. 1944. (Miscellaneous mycological notes.) *Ber. Schweiz. bot. Ges.*, **54**, 18 pp. (Condensed from *Rev. appl. Mycol.*, **25**, pp. 46-7.)

Infection tests showed that the pycnidia and aecidia of *Puccinia ribesii-diversicoloris* are able to develop on gooseberry, red currant, *Ribes alpinum*, *R. aureum*, *R. petraeum* and *R. sanguineum*, but not, apparently, on black currant. In nature, so far as the author is aware, they occur only on *R. alpinum* and gooseberry; locally, they are common on the former and rare on the latter.

638. McCallum, A. W. 1927. Forest pathology. *Rep. Domin. Botanist for 1926, Dep. Agric. Canada*, pp. 17-20. (Condensed from *Rev. appl. Mycol.*, **7**, p. 349.)

A survey in the county adjacent to the Ottawa River and in the French River district revealed no infection by *Cronartium ribicola* on the currant

types of *Ribes*, although *R. glandulosum* occurred in all types of country except bog. There was widespread infection on the gooseberry types of *Ribes*, the commonest of which was *R. oxyacanthoides*.

In the Kootenay area of British Columbia the two principal native *Ribes* are *R. viscosissimum* and the less susceptible *R. lacustre*. *R. petiolare* is less common, but is the most susceptible to the rust. On the coast *R. bracteosum* is the susceptible species.

639. McCartney, J. S. 1948. A study of the effects of α-naphthaleneacetic acid on prolongation of rest in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **52,** pp. 271-5.
Concentrations strong enough to prolong rest caused severe injury.

640. McClintock, J. A. 1930. The Van Fleet raspberry. *Circ. Tenn. agric. Exp. Sta.*, **29,** 4 pp.
The Van Fleet raspberry originated in 1911 as a seedling of *Rubus innominatus* from China crossed with Cuthbert red raspberry. It is tip rooting, vigorous, remarkably free from disease and withstands dry, hot weather. It is a late cropper and the fruit has undesirable characteristics in size, shape, colour and texture.

641. McDowell, C. H. 1944. Research serves agriculture. *Rep. Tex. agric. Exp. Sta.*, **57,** 49 pp.
Promising F_5 seedlings have been obtained from a cross between the Nessberry and the wild dewberry.

642. McMahon, B. 1806. Note on fall fruiting of the red raspberry. *Amer. Gard. Calend.*, p. 517.

Meader, E. M. 1944. *See* **Marth, P. C.,** and **Meader, E. M.**

Meader, E. M. 1954. *See* **Yeager, A. F.,** and **Meader, E. M.**

643. Melville, R. 1952. Co-existence of positive and negative heterosis in a single plant organ. *Nature, Lond.*, **169,** pp. 1054-5.
Mean leaf-shape was investigated in *Ribes sanguineum*, *R. odoratum* and their hybrid *R. gordonianum*. Leaf shape in *R. gordonianum* appears to depend upon the interaction between dominant or subdominant genes contributed by both parents, with growth in length under the control of genes from *R. odoratum* and general shape probably determined by genes from *R. sanguineum*. The latter species probably also contributed subdominant genes for absolute size of leaf.

644. Meurman, O. 1925. The chromosome behaviour of some dioecious plants and their relatives with special reference to the sex chromosomes. *Soc. Scient. Fennica, Comm. Biol.*, **2,** pp. 5-105.
No heterochromosome pair was discovered in pollen mother cells of male *Ribes alpinum* (2n=16), in contrast to the findings for other dioecious plants. The chromosomes of female *R. alpinum* have not yet been studied by the author. A review of previous work in this field is given.

645. Meurman, O. 1928. Cytological studies in the genus *Ribes* L. *Hereditas*, **11,** pp. 289-356.
A detailed description of meiosis in pollen mother cells of 14 *Ribes* species and 8 interspecific hybrids is given.

In the species examined, the somatic chromosome number was 16 and chromosome behaviour at meiosis was essentially the same with regular formation of 8 bivalents. Very occasionally univalents were seen. Differences in size were noted between the chromosomes of the various species and hybrids: *R. odoratum* and *R. leptanthum* have smaller chromosomes than the rest, and there is a clear size difference between the chromosomes of *R. sanguineum* and those of *R. aureum* [cf. Darlington, 1929]. There is a considerable range in size within the chromosome complement of any *Ribes* species or hybrid. The small size of the chromosomes, however, prevents exact classification. One chromosome pair with a relatively large satellite seems to be constantly present.

Side views of chromosome pairs at metaphase of meiosis showed that the homologous chromosomes in each pair were identical in volume in the species investigated. Irregularities in meiosis in *Ribes* species are rare and would not affect more than 1% of pollen mother cells in material grown under normal conditions.

Studies of the pollen mother cells of *R. saxatile* ♂ and of egg mother cells of *R. orientale* ♀ showed that no recognizable heterochromosome pair was present in either sex.

Meiosis in the pollen mother cells of the more or less fertile hybrids *R. holosericeum*, *R. robustum*, *R. succirubrum*, *R. innominatum* and *R. urceolatum* is described. In no case did the number of irregular reduction divisions exceed 5-10%. Except in *R. urceolatum*, not more than two univalents were seen at metaphase of the first division. These did not divide until the second division and often formed supernumerary nuclei. In *R. urceolatum*, up to 8 univalents were seen, some of which divided at the first division. Members of bivalents in these hybrids were of equal volume.

In the sterile hybrids *R. gordonianum*, *R. culverwellii* and *R. carrierei*, meiosis was considerably more irregular and members forming the bivalents were of different sizes. This is considered to confirm the observation that the homologous parental chromosomes differ in size, and shows that allosyndesis occurs. Since in fertile hybrids members of bivalents are the same size, it is concluded that the size difference is one of the reasons for the highly irregular meiosis and therefore of sterility.

In *R. gordonianum* chromosome pairing at meiosis was extremely irregular; from 0-16 univalents occurred at metaphase, the most frequent combination being $6_{ii} + 4_i$. The univalents divided at the first or second division and often did not reach the poles, forming micronuclei. Approximately 10% of cells showed 8_{ii}, and a few large cells with 16_i were seen. These formed a regular metaphase plate and divided equationally at the first division. Secondary splits showing at anaphase I suggested that a second division would take place leading to the formation of diploid gametes.

Meiosis in *R. culverwellii* was essentially similar to that in *R. gordonianum*, approximately 3% of cells showing 8_{ii}. The most common combination was $4_{ii} + 8_i$. Large cells with 16_i occurred as in *R. gordonianum*. In *R. carrierei* no statistical counts were made, but cells with 8_{ii} were again rare.

A small centric fragment is present in root tip and pollen mother cells of *R. gordonianum* and four very small fragments are nearly always present at anaphase in pollen mother cells of *R. sanguineum*. Fragments have also been seen in *R. carrierei* and in other *Ribes* species. The author states that anaphase bridges are by no means rare and considers this evidence refutes

Darlington's (1929) conclusion that fragmentation has played no part in the phylogeny of *Ribes*.

646. Mičurin, I. V. 1934. (Review of 60 years' work in breeding new varieties of fruits.) Moscow, 3rd edn, 366 pp.

647. Mičurin, I. V. 1936. (Pollination with mixed pollen. Horticulture by Mičurin's methods.) *Bull. Lenin Acad. Agric. Sci. Res. Inst. Fruit Gr. I. V. Mičurin*), No. 5, pp. 3-4. (Condensed from *Plant Breed. Abstr.*, **7,** p. 426.)

Where two species or genera are very difficult to cross, the author considers that the scent of the foreign pollen is an obstacle to fertilization. By placing a small amount of this pollen in a larger quantity of maternal pollen, the foreign pollen partially acquires the scent of the latter and successful pollinations have been made by this means. If larger quantities of the foreign pollen are available this is simply mixed with three times as much maternal pollen and the mixture is applied; by this means hybrids have been found among the seedlings, e.g. in a cross of *Rubus xanthocarpus chinensis rugosa* × *R. fruticosus*.

648. Mičurin, I. V. 1949. Selected works. Foreign Languages Publishing House, Moscow, 496 pp. Small fruit cultures (pp. 422-30).

Izobilnaja blackberry is a hardy seedling from Lucretia; it has a vertical root system so that close spacing is possible, and it is not exacting as to soil.

Produktivnaja (Komertsia raspberry × blackberry) does not tolerate low-lying damp conditions. The berries are dark red, conical, firm, and travel well.

Texas raspberry, a seedling of loganberry, has fruits up to 4 cm. long weighing 10 g.; they do not 'plug'.

Arabka, a *Rubus occidentalis* hybrid with black fruits, is twice as hardy as Texas raspberry.

Damskaya, from Eureka × Marlboro, is thornless and remarkably hardy.

Crandall currant, regarded as a variety of *Ribes aureum*, lacks hardiness. Seedlings of Crandall [? open pollinated] segregated for black, red, and yellow fruit and for hardiness. The second generation yielded fertile seedlings practically immune to frost damage; they were, however, difficult to propagate from cuttings and propagation from seed is recommended.

649. Mielke, J. L., and **Hansbrough, J. R. 1933.** Susceptibility to blister rust of the two principal *Ribes* associates of sugar pine. *J. For.*, **31,** pp. 29-33. (Condensed from *Rev. appl. Mycol.*, **12,** p. 407.)

Both *Ribes roezlii* and *R. nevadense* proved highly susceptible to *Cronartium ribicola* in California, the former being defoliated before teleutospores could be produced in any numbers and the latter forming teleutospores in profusion. *R. sanguineum* was moderate both in susceptibility and teleutospore production while *R. lacustre* was generally fairly resistant and formed relatively few teleutospores.

650. Mielke, J. L., Childs, T. W., and **Lachmund, H. G. 1937.** Susceptibility to *Cronartium ribicola* of the four principal *Ribes* species found within the commercial range of *Pinus monticola*. *J. agric. Res.*, **55,** pp. 317-46.

Ribes petiolare and *R. inerme* proved extremely susceptible, approaching black currant in both severity of infection and production of telia. *R. inerme* bore abundant telia when growing in shade. *R. viscosissimum* and *R. lacustre* are more resistant, the latter occasionally becomes moderately infected but produces few telia.

651. Mielke, J. L. 1938. An example of the ability of *Ribes lacustre* to intensify *Cronartium ribicola* on *Pinus monticola*. *J. agric. Res.*, **55.** p. 873-82.
R. lacustre, as an alternate host of *C. ribicola*, constitutes a far greater menace to *P. monticola* than was previously assumed.

652. Mielke, J. L. 1938. Spread of blister rust to sugar pine in Oregon and California. *J. For.*, **36,** pp. 695-701.
As in earlier tests, *Ribes cruentum* and *R. nevadense* were very susceptible to *Cronartium ribicola*; *R. glutinosum* proved strongly resistant.

653. Mielke, J. L. 1941. *Ribes petiolare* Dougl. in California. *Madroño, S. Francisco*, **6** (1), pp. 30-1.
R. petiolare, one of the most susceptible of western currants to *Cronartium*, grows in dense concentrations in association with *Pinus albicaulis*.

Mielke, J. L. 1944. *See* **Kimmey, J. W.,** and **Mielke, J. L.**

654. Mihaljčenkova, E. 1947. (On the necessity of pollinators for raspberry varieties.) *Agrobiology, Moscow*, No. 2, pp. 65-70. (Condensed from *Plant Breed. Abstr.*, **19,** p. 156.)
The varieties Usanka, Maljboro [Marlboro], Prusskaja [? Preussen], and Novostj Kuzjmina, are only partially self-fertile.

655. Mikolaičuk, I. A. 1948. (The correlation between the colour of the stem and the colour of fruits of gooseberry.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 9, p. 77. (Condensed from *Plant Breed. Abstr.*, **19,** p. 394.)
Seedlings from the cross of the Mičurin gooseberry variety Černyĭ Negus with the European gooseberry Triumf Belyi (White Triumph) segregated for shoot colour. Of 33 green shooted plants, 32 yielded yellow or green fruits, whereas 27 out of 29 red shooted plants produced red fruits.

Miller, A. 1949. *See* **Hahn, G. G.,** and **Miller, A.**

656. Mills, W. H. 1950. *Rubus watsonii* sp. nov. *Watsonia*, **1,** pp. 135-6.

657. Modlibowska, I., and **Ruxton, J. P. 1953.** Preliminary studies of spring frost resistance of black currant varieties. *Rep. E. Malling Res. Sta. for 1952*, pp. 67-72.
None of the varieties tested was markedly resistant to frost. Results with cut racemes showed a tendency for Seabrook's Black and Cotswold Cross to be less damaged than the other varieties tested, and for Mendip Cross and Goliath to be more damaged, but the differences were often small.
Results with bushes in pots, where a lesser number of varieties was tested, showed larger and more consistent differences, with Seabrook's Black and Amos Black least damaged of the varieties tried, and Wellington XXX and Boskoop Giant the most damaged. Amos Black was not included in the raceme test.

Open flowers of Seabrook's Black were more resistant to frost damage than those of the other varieties tested.

Buds were more damaged than open flowers; thus, as blossom time approaches, the black currant increases in frost susceptibility up to the 'grape' stage and then, as the blossoms open, becomes more resistant. Thus later flowering does not *always* confer protection against frost, and this may explain the varying observations on varietal susceptibility in the field.

Modlibowska, I. 1954. *See* **Ruxton, J. P.,** and **Modlibowska, I.**

658. Moffett, A. A. 1930. *Rubus. Rep. John Innes hort. Instn for 1929,* p. 25.

The chromosome numbers of 7 varieties of autumn fruiting raspberries are reported: Lloyd George and Queen Alexandra are diploids (2n=14); Belle de Fontenay, November Abundance, and Merveille Rouge are triploids (2n=21); Hailsham berry and Everbearing are tetraploids (2n=28). The triploid varieties produce very little good pollen and it seems possible that they may really be natural seedlings of the varieties whose names they bear, due to crossing of a tetraploid and a diploid.

Two seedlings of Veitchberry × Lloyd George ($4x \times 2x$) were found to be aneuploids with 22 and 23 chromosomes. Hitherto aneuploidy has not been reported in the genus.

659. Möhring, —. 1935. (A cross between the black currant and the gooseberry (Worcesterberry).) *Rhein. Machr. Obstb.*, **28,** p. 208. (Reported by Nilsson, F., 1955.)

Describes the Worcesterberry, and points out that it is obviously not the same hybrid as *Ribes culverwellii.*

660. Moir, W. S. 1924. White pine blister rust in western Europe. *Bull. U.S. Dep. Agric.*, **1186,** 32 pp.

Covers the history, development, and distribution of *Cronartium ribicola* in Europe and includes a list of nearly 50 susceptible species of *Ribes* of which 22 occur in America.

Moore, M. H. 1940. *See* **Harris, R. V., Beakbane, A. B.,** and **Moore, M. H.**

Moore, R. C. 1949. *See* **Oberle, G. D., Moore, R. C.,** and **Nicholson, J. O.**

Moore, R. C. 1952. *See* **Oberle, G. D.,** and **Moore, R. C.**

661. Morris, H. F. 1934. A study of blackberry and dewberry varieties as breeding material. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 117-21.

The characters of a number of varieties under Texas conditions are discussed. *Rogers* is small and prostrate and sets its crop so early that most of it is lost; *Evergreen* seems to use up its energy in maintaining its growth during the winter; it is also very susceptible to 'double blossom'. *Himalaya* is vigorous but late and sets only a few partially developed fruits. *Cory's Thornless* sets little fruit and is susceptible to double blossom. The thornless dewberries give low yields and weak plants—all thornless varieties appear to be susceptible to leaf spot (*Cylindrosporium rubi*), and

to anthracnose. *Crystal White* and *Iceberg* give a packed fruit of poor appearance and mushy condition. The *Pink* blackberry shows very low resistance to cold—when not frosted it suffers from too dense and thorny a growth, and the fruit colour is poor. *Mammoth* (closely related to *Cory's Thornless*) is very susceptible to double blossom and anthracnose; it is prostrate and very thorny and does not stand hot dry weather.

Mt Pocono, *Joy*, *Macatawa*, *Marvel*, and *Louisiana Seln. No. 2*, show weak growth and poor yield. *Stoneshardy*, *Snyder*, *Ward*, *Taylor*, *Early King*, *Badger*, and *Mersereau* set fair crops but yield and quality are low because of late maturity. All late maturing varieties have proved more susceptible to nematodes.

Hall's Lawton, a selection of the Lawton blackberry, has vigorous upright growth with little susceptibility to disease or nematodes. It sets and matures a heavy early to mid-season crop of medium to large, firm, acid fruits with large seeds and fair flavour. Canning quality is good. Propagation is by root cuttings.

Youngberry sets a heavy medium-early crop of large fruit of excellent flavour. Propagation is by tip-layering and cuttings from current season's growth.

Crandall's Early is a vigorous semi-erect variety with mid-season fruit of excellent flavour. According to Darrow, *Crandall's Early* and *Macatawa* are synonyms, but the latter proved poorly adapted to East Texas, and appeared morphologically distinct from Crandall's Early.

Hall's Lawton, Youngberry, and Crandall's Early are being used as male parents.

The following varieties are being used as females: *Early Harvest*, high yield, low acidity, small seeds, few small prickles; *Haupt*—earliness, vigour, high yield; *McDonald*—high yield of early, medium sized, thin skinned fruit, self-sterile; *Austin Thornless*—solely for absence of thorns; *Austin* is very early and produces a heavy crop; *Rogers* for extreme earliness and firm fruit; *Dallas*—high yield of firm mid-season berries; *Rathbun*—high yield of small, firm, sweet fruit, small seeds, few prickles, upright; *Lucretia*—extra large fruit but the seed is large and the habit prostrate; *Kenoyer* is upright, vigorous and with many fruits per cluster, easy to pick.

662. Morris, H. F. 1938. The effects of partial sterility on fruit and cane development of blackberry and dewberry varieties. *Proc. Amer. Soc. hort. Sci.*, **35,** pp. 492-4.

Somatic mutation was considered unlikely as the cause of the partial sterility, the trouble being probably due to a virus or other organism.

Morris, H. F. 1939. *See* **Yarnell, S. H.,** and **Morris, H. F.**

663. Morrow, E. B., Darrow, G. M., and **Scott, D. H. 1954.** A quick method of cleaning berry seed for breeders. *Proc. Amer. Soc. hort. Sci.*, **63,** p. 265.

664. Mowry, H. 1931. Variety tests of berries. *Rep. Fla agric. Exp. Sta.*, pp. 97-8.

665. Mueller, P. J., and **Lefevre, V. 1859.** (Tentative monographical presentation of the Franco-German species of the genus *Rubus.*) *Jb. Pollichia*, **16,** pp. 74-298.

666. Mumford, H. W., and **Keilholz, F. J. 1928.** A year's progress in solving farm problems in Illinois. *Rep. Ill. agric. Exp. Sta.*, 321 pp.
A number of hybrid raspberries combining resistance to anthracnose with good size, quality and yield have been bred. Some selfed seedlings were more resistant to anthracnose than were their parents. The percentage of promising seedlings combining anthracnose resistance with other good qualities, varied from 9% with Royal to 80% with Quillen. Other varieties producing promising seedlings include Black Pearl, Cumberland, Honeysweet, and Older.

Reciprocal crosses between certain black and red raspberries differed in anthracnose susceptibility, e.g. Plum Farmer × June yielded more resistant seedlings than did June × Plum Farmer.

The range in susceptibility suggests that anthracnose resistance is determined by more than a single gene.

667. Mumford, H. W. 1930. A year's progress in solving farm problems of Illinois. *Rep. Ill. agric. Exp. Sta.*, 296 pp.
A. S. Colby (reported on pp. 246-7) found pronounced resistance to anthracnose in a high percentage of Quillen seedlings. Some seedlings of Black Pearl have yellow canes and salmon-coloured fruit, others bear black fruit of high quality.

Mundinger, F. G. 1953. *See* **Slate, G. L., Braun, A. J.,** and **Mundinger, F. G.**

668. Murrill, W. A. 1944. More about white blackberries. *Science*, **99,** pp. 513-14.

669. Murrill, W. A. 1945. A white blackberry. *J. Hered.*, **36,** pp. 217-18.
At three places in Florida, recessive 'white'-fruited mutants of *Rubus cuneifolius* Pursh. (the common sand blackberry) have been found. The white-fruited form is completely self-incompatible and the fruits do not develop without pollination.

670. Muskett, A. E., and **Turner, E. 1927.** The control of American gooseberry mildew in Northern Ireland. *J. Minist. Agric. N. Ireland*, **1,** pp. 45-67.
Mutton was more resistant to *Sphaerotheca mors-uvae* than was Whinham's Industry; the American varieties Charles, Sylvia and Mabel were immune, but the crop was small and of poor quality.

Myhre, A. S. 1953. *See* **Schwartze, C. D.,** and **Myhre, A. S.**

Nannenga, E. T. 1949. *See* **Kronenberg, H. G.,** and **Nannenga, E. T.**

671. Nattrass, R. M. 1928. Economic mycology. *Rep. Long Ashton Res. Sta. (1927)*, pp. 202-12.
Leaf spot of black currants, *Pseudopeziza ribis*, almost defoliated many acres of Baldwin, but Davison's Eight and Edina were markedly resistant; hard pruned bushes of Baldwin showed considerable resistance.

The raspberry varieties Northumberland Thornless Fillbasket and Baumforth E were badly attacked by *Sphaerotheca humuli*; Reader's Perfection and Semper Fidelis B showed a rather lesser attack and Baumforth B, Lloyd George, Red Cross, Goliath, Hornet D, and Maclaren's Prolific were only slightly affected.

Nees von Esenbeck, C. G. 1822-7. *See* **Weihe, K. E. A., and Nees von Esenbeck, C. G.**

672. Neger, F. W. 1908. Inoculation experiments with *Peridermium strobi* from *Pinus monticola*. *Naturw. Z. Forst- u. Landw.*, **6,** p. 605. (Condensed from *Exp. Sta. Rec.*, **20,** p. 951.)
Plants of *Ribes sanguineum*, *R. alpinum*, *R. rubrum*, *R. aureum* and *R. grossularia* were grown alongside a vigorous stand of *Pinus monticola*. Only *R. sanguineum* became infected with *Peridermium strobi*. It is considered, however, that *R. alpinum* is the alternate host for the form of the disease occurring on the stone pine (*P. cembra*).

673. Nelson, E. K. 1925. The non-volatile acids of the strawberry, the pineapple, the raspberry and the Concord grape. *J. Amer. chem. Soc.*, **47,** pp. 1177-9.
The non-volatile acids in the red raspberry consist of 97% citric acid and 3% l-malic acid, while the black raspberry contains 100% citric acid.

674. Nelson, E. K. 1927. The non-volatile acids of the pear, quince, apple, loganberry, blueberry, cranberry, lemon, and pomegranate. *J. Amer. chem. Soc.*, **49,** pp. 1300-2.
About 96% of citric acid and 4% of l-malic acid were found in loganberries; isocitric acid was not detected.

Nelson, E. K. 1943. *See* **Curl, A. L., and Nelson, E. K.**

675. Ness, H. 1919. Experiences in plant hybridization. *Proc. Amer. Soc. hort. Sci.*, **16,** pp. 52-60.
F_2s of cultivated blackberries · dewberries have been raised. In crosses of *Rubus rubrisetus*, the Louisiana dewberry, with Brilliant and Loudon red raspberries, the F_1 was almost completely sterile, but in F_2, 5 plants set perfect fruits and bred true. The fruit differed from both blackberry and raspberry in that the calyx remained attached to the picked berry.

676. Ness, H. 1921. Breeding work with blackberries and raspberries. *J. Hered.*, **12,** pp. 449-55.
The origin of spineless forms from the McDonald blackberry and their hybrids with Early Harvest (*Rubus floridus*) are described, as are crosses between Austin-Mayes (*R. baileyanus* × *R. floridus*) and Early Harvest. All of these have been summarized in more detail under Ness, 1925.
In the cross *R. rubrisetus* · *R. strigosus*, the F_1 plants closely resembled *strigosus* but were nearly sterile. Of the F_2 plants, five were fruitful and a numerous F_3 population was raised from these. Sample plants from this F_3 showed an extremely protracted fruiting period partly due to tip flowering.

677. Ness, H. 1925. Breeding experiments with blackberries and raspberries. *Bull. Tex. agric. Exp. Sta.*, **326,** 28 pp.
In the seedling progeny of McDonald blackberry, of two selected plants which were entirely without spines or pubescence on any of their organs, one was erect, the other diffuse or even prostrate. Subsequent generations from the erect plant suffered heavy mortality in the nursery and the type was lost in the third generation. The 'erect' and 'diffuse' characters did not breed true but about half the seedlings in each generation from both of the original plants were spineless. These spineless plants were distinguished

by the smooth, firm, lanceolate form of their first leaves (very similar to violet leaves). The other half of the seedlings were similar in all features to the spiny McDonald. Seedlings of spineless forms suffered heavy mortality, and about 30% were devoid of chlorophyll. Twenty-nine plants of the third generation of spineless-diffuse reached bearing maturity. They had the characteristic violet form of leaves in the nursery, but at maturity they were classified as 10 spines absent, 8 spines few or inconspicuous, 3 spines evident, 8 both spines and bristles conspicuously present.

An F_2 plant of Austin × Early Harvest with predominantly Early Harvest characters was crossed with the spineless-erect form (as male). Four plants resulted, three being characteristic of Early Harvest and the other being spineless. A large number of seedlings of this spineless plant were devoid of chlorophyll and died. Those surviving developed into two distinct groups: one with 'violet' leaves and the other with rugose and laciniate margined (Early Harvest type) leaves. Seventy-seven plants of the first group and 130 most typical of the second were transplanted into the field. The Early Harvest types retained their characteristics. Some of the spineless plants developed a spiny and sulcate form of stem similar to Early Harvest but the spineless leaf form and texture were retained.

The cross Dallas (*Rubus nigrobaccus*) × Mammoth (a hybrid between *R.* [*ursinus*] *vitifolius* and *R. nigrobaccus*) gave a proportion of plants in which the inner whorl of stamens was replaced by accessory receptacles bearing pistils but this character showed blending inheritance in F_2. In a cross of (Dallas × Mammoth) × Logan F_1 there was no vestige of stamens in several plants.

The Nessberry is a multiple selection from the F_3 of *Rubus rubrisetus* and Brilliant (*R. strigosus*). The Nessberry, self-fertile and hybridizing readily with other forms of *Rubus*, is a very vigorous plant with large dark cherry-coloured fruits mildly acid and raspberry-like in flavour.

In the cross of *R. rubrisetus* × *R. neglectus* ♂ the characteristics of the male parent predominated in all organs but the flowers were almost completely sterile. The F_2 and F_3 generations were similar to the F_1 but the flowers were larger and were perfect.

Crosses were made between the breeding line afterwards called Nessberry as male and the largely sterile F_1 of *rubrisetus* × *neglectus*. In F_2 there was no segregation, all the plants were fertile and had fruit similar to that of the Nessberry in size and form but duller and more tart.

Nessberry × Himalaya F_1 was uniformly of Himalaya character though earlier, shorter, and more erect; the plants gave perfect fruit.

Nessberry × *rubrisetus*, and the reciprocal, both gave seed but those from the reciprocal failed to germinate. The F_1 of this cross consisted of 3 plants similar in all respects to Nessberry and 24 plants all more or less sterile and intermediate in appearance.

Nessberry × Spineless-diffuse gave 16 plants of which 6 were like McDonald, 6 like *rubrisetus*, 2 like Nessberry and 2 Spineless-diffuse.

Nessberry × Brighton and Nessberry × Hailsham gave only more or less sterile plants in F_1.

678. Neumann, U. 1953. (Investigations into the causes of premature fruit drop in black currants.) *Kühn-Archiv.*, **67**, p. 402. (Condensed from *Plant Breed. Abstr.*, **24**, p. 461.)

Fruit drop is partially attributable to insufficient natural pollination and may be reduced by artificial pollination. Westwick Triumph was the least

susceptible to premature fruit drop of the varieties observed. In general, varieties with short racemes suffered less than those with long racemes.

679. Neumann, U. 1955. (The importance of fertilization conditions and cultural measures for premature fruit drop in black currants.) *Arch. Gartenb.*, **3,** pp. 339-54. (Condensed from *Plant Breed. Abstr.*, **26,** p. 664.)

Investigations showed that insufficient natural pollination is the main cause of fruit drop and that yields can be substantially increased by artificial pollination. The varieties tested were divided into three categories. (1) Fully self-fertile types such as Goliath, Rosenthals Schwarze, and Boskoop Giant—although supplementary pollination improved the yield of these, self pollen was as effective as pollen from other varieties. (2) Largely self-fertile varieties (e.g. Wellington and Westwick Choice) giving somewhat higher yields when cross pollinated. (3) Largely self-sterile types giving only 20-30% as much fruit when selfed as when cross pollinated, e.g. Laxton's Mite-free, Invincible Giant, and Black Naples. Varieties of the third group gave lower yields than those of the first when pollinated with pollen of another variety, possibly owing to their having fewer ovules. The number of seeds per berry showed positive correlation with yield, making selection for high yield coupled with few seeds per berry unlikely to succeed in the material under observation.

The cultivation of varieties in the third group is not recommended; to obtain satisfactory yields from the second group, at least two or three varieties should be grown together. Hormone treatment is not considered of practical value in reducing fruit drop.

680. Newman, C. P. 1916. Some results in raising new raspberries. *Rep. Pomol. Fruit Gr. Soc., Quebec*, pp. 114-21.

681. Newton, G. A. 1930. Report of the Department of Plant Pathology. *Bull. West. Wash. St. Exp. Sta.*, **18-W,** pp. 18-21.

Black raspberries were found to be much more susceptible to virus diseases than reds.

Nicholson, J. O. 1949. *See* **Oberle, G. D., Moore, R. C.,** and **Nicholson, J. O.**

682. Nilsson, F. 1940. (Some discoveries and impressions of horticulture in Norrland.) *Fruktodlaren*, No. 1, pp. 16-19. (Condensed from *Plant Breed. Abstr.*, **11,** p. 321.)

Under Norrland's severe winter, only the small fruited varieties of gooseberry that have been brought into cultivation from the wild are completely hardy and produce well. There is much variation in these wild forms and some are resistant to mildew, including the small-fruited, hairy variety Scania. From crosses between a Norrland hardy, mildew-resistant type and English large-fruited varieties it should be possible to produce a good variety suitable for Norrland.

683. Nilsson, F. 1944. (Tetraploid types in the genus *Ribes.*) *Sverig. Pomol. Fören. Årsskr.*, **45,** pp. 130-4. (Condensed from *Plant Breed. Abstr.*, **17,** p. 86.)

Experiments on the induction of tetraploidy by colchicine treatment of *R. grossularia, R. petraeum, R. nigrum*, and *R. nigrum* × *R. grossularia* are

described. The hybrid of *R. nigrum* × *R. grossularia* made in 1939 proved intermediate between its parents. It flowered in 1943, but backcrosses failed. Colchicine treatment of cuttings has given a plant thought to be amphidiploid.

684. Nilsson, F. 1948. (Practical results from breeding of small bush fruits.) *Årsb. Svensk JordbrForsk.*, pp. 137-46. (Condensed from *Plant Breed. Abstr.*, **19,** p. 392.)

Ribes divaricatum and *R. niveum* have been crossed at Alnarp with European varieties of gooseberry, and the hybrids have shown exceptional mildew resistance and good quality; backcrosses to large-fruited varieties are to be made to increase fruit size.

Like the red currant, the black currant grows wild in parts of Sweden. Varieties from Haparanda, Ertheikki and Ostersund have shown remarkable hardiness and adaptation to northern conditions.

Details are given of the raspberry varieties Miranda and Mitra, bred by E. Johansson (1947).

The highest yielding blackberry grown in Sweden is Armeniska which is, however, confined to the south because of its lateness and insufficient winter hardiness.

685. Nilsson, F. 1949. Polyploids in *Ribes*, *Fragaria*, *Raphanus* and *Lactuca*. *Proc. 8th int. Congr. Genet. Stockh.* (*Suppl. Hereditas*), pp. 34-5.

The following hybrids have been obtained: *Ribes nigrum* × *R. grossularia*, *R. nigrum* × *R. rubrum*, *R. nigrum* × *R. sanguineum*, *R. nigrum* × *R. niveum*, and *R. grossularia* × *R. divaricatum*. The last two are fully fertile [sic] but the other hybrids are more or less sterile, though *nigrum* × *sanguineum* and *nigrum* × *niveum* both show some fertility. Colchicining *R. nigrum* × *R. grossularia* during several years yielded one polyploid branch on which fruits developed, and from these fruits a few seedlings have been obtained. The fruits are large and black and intermediate in size and taste between the parents.

686. Nilsson, F. 1949. (Varieties of black currants.) *Fruktodlaren*, No. 2, pp. 47-8.

687. Nilsson, F. 1951. (Gooseberries, black and red currants.) *Svensk Växtförädling*, **2,** pp. 121-38.

688. Nilsson, F. 1951. (Interspecific hybrids and tetraploids within the genus *Ribes*.) *Nord. JordbrForskn.*, **31-2,** pp. 418-24. (From *Plant Breed Abstr.*, **22,** p. 287.)

A detailed account is given of many interspecific hybrids of *Ribes*, especially those obtained by Viksne in Latvia and by the author in Sweden. Tetraploid forms of various species and interspecific hybrids are also described.

Information is given on the distribution of the species and forms and on the chromosome number of the genus *Ribes*.

A new tetraploid fertile species with 2n=32 has been obtained by colchicine treatment of the hybrid *R. nigrum* × *R. grossularia*.

689, Nilsson, F. 1953. (The gooseberry-currant, an interesting novelty.) *Årsk. svensk JordbrForsk.*, p. 101.

A fertile, tetraploid black currant-gooseberry hybrid has been called

Ribes nigrolaria. It has smooth black fruits, larger than black currants and not usually attacked by mildew, although the tips of shoots may be affected when conditions favour the development of the fungus. The number of seeds per fruit is low and propagation is by cuttings.

690. Nilsson, F. 1955. Amphidiploid species in the genus *Ribes*. *Rep. 14th int. hort. Congr.*, Scheveningen, pp. 697-711.

Three intersectional species hybrids are described. All are sterile in the diploid stage.

Ribes nigrum L. × *R. grossularia* L.—The F_1s are spineless and lack the characteristic odour of *R. nigrum*. Occasional parthenocarpic fruits were set by plants from the cross Boskoop Giant × Early Sulphur and also by two plants of (Boskoop Giant × Goliath) × Achilles parentage. Fertile tetraploid plants were obtained by treating buds in early spring with 0·5-1·0% colchicine solution. Fertile F_2 seedlings with $2n=32$ chromosomes have been obtained; these have been named *R. nigrolaria*. The following data are taken from a table comparing numerous characteristics of the parents and the 2*x* and 4*x* F_1 plants:

	R. nigrum	*R. grossularia*	*F_1 2x*	*F_1 4x*
Size of stomata	7·7	7·2	8·7	10·0
No. of flowers per raceme	9·5	2·0	3·4	1·7
Pollen fertility % ..	96·0	97·0	±0·0	92·0
Weight of 100 fruits, g.	94·0	214·0	—	244·0
Weight of 1,000 seeds, g.	2·3	4·5	—	7·0
No. of seeds per fruit ..	5·2	5·4	—	3·6

The fruits of the 4*x* F_1 plants are almost glabrous, dark-red to black. The 2*x* F_1 plants are practically immune to *Sphaerotheca mors-uvae*, but the tetraploids are slightly susceptible. F_2 and F_3 plants have been obtained, variation within and between generations, for vegetative characters, being small. Backcrosses of the 2*x* F_1 seedlings to both parent species failed, but seeds were produced when tetraploid hybrids were crossed with 4*x* *R. nigrum*.

R. nigrum × *R. niveum* Lindl.—*R. nigrum* has been successfully crossed with *R. divaricatum*, *R. niveum*, and *R. oxyacanthoides*. All these F_1 hybrids are very resistant to *S. mors-uvae*, the F_1 of *nigrum* × *niveum* being immune. Seedlings of the latter cross are spineless and glandless. Although the pollen is inviable, some fruits containing seeds are formed. A few seedlings raised from these seeds were very similar to *R. nigrum* and were obviously backcrosses. Fertile tetraploid F_1 plants were obtained by soaking seeds in a 2% colchicine solution before germination. The following data are given, *inter alia*:

	R. nigrum	*R. niveum*	*F_1 2x*	*F_1 4x*
Size of stomata	7·7	8·6	8·2	12·5
No. of flowers per raceme	9·5	3·0	4·5	3·0
Pollen fertility % ..	96·0	98·0	±0·0	98·0
Weight of 100 fruits, g.	94·0	50·0	—	86·0
Weight of 1,000 seeds, g.	2·3	9·5	—	4·1
No. of seeds per fruit ..	5·2	2·6	—	5·9

The tetraploid plants are slightly susceptible to *S. mors-uvae*. They have been successfully backcrossed. The new tetraploid species has been named *R. nigroveum* and is described.

R. sativum Syme. × *R. nigrum*.—F_1 plants from the cross Red Cross × Boskoop Giant, and the reciprocal, are vigorous and glandless. Backcrosses to the parents have failed. On one occasion a few fruits containing seeds which did not germinate were formed. Three F_2 seedlings were raised from a colchicined tetraploid F_1 plant. Two of these F_2 plants were $2n=32$, the third was $2n-31$. The new tetraploid species has been named *R. satigrum*. The following data are given, *inter alia*:

	R. sativum	*R. nigrum*	F_1 *2x*	F_1 *4x*
Size of stomata	9·0	7·7	8·3	10·9
No. of flowers per raceme	9·0	9·5	14·0	10·3
Pollen fertility % ...	95·0	96·0	±0·0	97·0
Weight of 100 fruits, g.	43·0	94·0	—	58·0
Weight of 1,000 seeds, g.	7·2	2·3	—	5·6
No. of seeds per fruit ..	2·9	5·2	—	1·5

Intrasectional species hybrids are easily made and are often fertile, whereas intersectional hybrids are all sterile. Differentiation of sections and species is considered to be due, not to polyploidy, but to structural differences in the chromosome complement.

In general, artificial doubling of fertile F_1 hybrids and species reduced fertility; the tetraploid *R. nigrum* was the only one showing considerable fertility. This species is also fertile at the triploid level and hybridizes more readily than any other *Ribes* species.

691. Noordanus, G. 1926. (Mosaic disease of raspberries.) *Floralia*, **47** (30), pp. 472-3.

The most severe mosaic symptoms were observed on Hornet and Superlative. Devon showed resistance and Lloyd George was entirely 'immune'.

692. Nyhlén, Å. 1951. (Variety trials with gooseberries at Nyckelby, 1942-1950.) *Årsb. Svensk JordbrForsk.*, pp. 106-11. (Condensed from *Plant Breed. Abstr.*, **21**, pp. 956-7.)

In the trials Champagne Green, Triumphant and Achilles, closely followed by Whitesmith, gave the best yields, and the same varieties also did well in a variety collection. They were not specially subject to mildew and their keeping quality was classed as good or average. In the collection, Thaser White gave a remarkably high yield and proved fairly free from mildew.

693. Oberle, G. D., Moore, R. C., and **Nicholson, J. O. 1949.** Parents used in breeding autumn-fruiting red raspberries for Virginia. *Proc. Amer. Soc. hort. Sci.*, **53**, pp. 269-72.

Sunrise, a seedling of Ranere, appears to carry a genetic factor or factors for the autumn-fruiting character which differs from the factor or factors possessed by Indian Summer, derived from Lloyd George. Sunrise appears promising as a parent in breeding autumn fruiting red raspberries for Virginia, because it is adapted to Virginia conditions and its seedlings ripen their autumn crop early.

The percentages of autumn fruiting plants obtained from the various crosses were: Indian Summer × Sunrise 24%, Indian Summer × Latham 6%, Taylor × Sunrise 21%, Sunrise × Newburgh 5%, Sunrise × Marcy 22%. Populations in the last two crosses were very small. The advantage of the first cross over the third was the far greater earliness of the autumn crop in the autumn fruiting selections.

694. Oberle, G. D., and **Moore, R. C. 1952.** Transmission of the autumn-fruiting character in crosses of red and black raspberries. *Proc. Amer. Soc. hort. Sci.*, **60,** pp. 235-7.

The data from this paper are summarized in the table extracted below.

Autumn-fruiting segregations in populations of seedling raspberries grown at Blacksburg, Virginia, in 1951

Parentage	*Population*	*Number autumn fruiting*	*Percent autumn fruiting*
Bristol × Durham	181	83	46
Bristol × September	185	106	57
Bristol × Indian Summer	206	94	46
Cumberland × September	284	146	51
Indian Summer × Chief	69	19	28
Indian Summer × Durham	28	26	93
Indian Summer × September	10	9	90
Marcy × St. Regis	111	50	45
St. Regis × Cuthbert	30	19	63
Sunrise × Chief	82	3	4
Sunrise × Durham	250	160	64
Sunrise × Marcy	130	30	23
Sunrise × September	44	26	59
Taylor × St. Regis	148	53	36
Taylor × Sunrise	94	22	23
Willamette × St. Regis	161	122	76

695. Odland, T. E., and **Stene, A. E. 1936.** Inheritance in blackberries. *Proc. Amer. Soc. hort. Sci.*, **33,** pp. 423-6.

The varieties are classified according to their habit of growth and thorniness, only Mayes Thornless and Santa Rosa being thornless. Thornlessness and trailing habit appear to be dominant characters.

Odland, T. E. 1938. *See* **Stene, A. E.,** and **Odland, T. E.**

696. Offord, H. R. 1940. The function of tannin in host-parasite relationships, with special reference to *Ribes* and *Cronartium ribicola*. *Bull. U.S. Bur. Ent.*, **E518,** 27 pp.

The quantity of tannin in leaves, stems and roots of six *Ribes* species could not in itself be used as the sole index of the reaction of the species to *C. ribicola*. An analysis of the decomposition products of the tannin mass of *R. petiolare* and *R. inerme* (highly and moderately susceptible respectively) revealed in the latter a higher content of catechol tannins, which probably exerted a stronger specifically toxic action on the rust than the tannins of the former species, which were predominantly of the gallotannin type. Differences were further detected in the ratio of alcohol to water-soluble tannins between *R. petiolare* and the less susceptible *R. inerme, R. lacustre*, and *R. viscosissimum*.

697. Offord, H. R., Quick, C. R., and **Moss, V. D. 1944.** Self-incompatibility in several species of *Ribes* in the Western States. *J. agric. Res.*, **68,** pp. 65-71.

Self-pollination of *R. roezlii, R. glutinosum, R. nevadense*, and *R. viscosissimum* failed to give a single fruit although a total of 736 flowers were

pollinated. Intra-specific cross pollination was successful in all four species although, on an average, less than 50% of the flowers formed fruits.

698. Oldham, C. H. 1946. The cultivation of berried fruits in Great Britain. Crosby Lockwood & Son Ltd., London, 374 pp.

Olmo, H. P. 1944-53. *See* **Brooks, R. M.,** and **Olmo, H. P.**

699. Oosten, A. van. 1955. (New raspberry varieties.) *Fruitteelt*, **45,** p. 884.

700. Orchard, H. E. 1950. Weeds of South Australia. Blackberry (*Rubus fruticosus* L.) and allied *Rubus* species. *J. Dep. Agric. S. Aust.*, **53,** pp. 495-8.
Four species of *Rubus* grow wild in S. Australia, viz. *R. fruticosus* (blackberry), *R. laciniatus* (cut-leaved blackberry), *R. moluccanus* (molucca bramble), and *R. parvifolius* (small-leaved bramble). Their characters are tabulated for identification.

701. Overcash, J. P. 1953. Raspberry variety sought for Mississippi conditions. *Miss. Fm Res.*, **16,** No. 12, p. 5. (From *Plant Breed. Abstr.*, **24,** p. 460.]
Raspberries are being bred suitable for the hot, dry conditions in Mississippi. Three oriental species, *Rubus biflorus* and *R. kuntzeanus*, upright types, and *R. parvifolius*, a trailing type, have been used in crosses to obtain plant vigour.

702. Painter, A. C. 1948. East Malling raspberries. *Rep. E. Malling Res. Sta. for 1947*, pp. 171-2.
Abridged descriptions are given of the following Malling varieties and seedlings: Enterprise, Landmark, Notable, Promise, and Seedlings G, J, K, and M [all previously described by Grubb (1943, 1946) and Grubb and Harris (1947).

703. Palmer, E. F. 1922. Solving the fruit growers' problems by plant breeding. *Proc. Amer. Soc. hort. Sci.*, **19,** pp. 115-24. (Condensed from *Exp. Sta. Rec.*, **49,** pp. 436-7.)
Crosses between gooseberry and black currant have resulted in two distinct types of plants, one closely resembling the black currant and the other similar to the gooseberry, but practically lacking thorns, and sterile.
In raspberry breeding, Marlboro × Cuthbert crosses have been the most successful.

704. Palmer, E. F., and **Strong, W. J. 1927.** A note on raspberry breeding. *Sci. Agric.*, **7,** p. 387.
Although purple-fruited raspberries were obtained from crosses in which the black-fruited form was the female, in the reciprocal crosses only red-fruited seedlings were obtained.

705. Panasjuk, M. I. 1952. (Dessert wines from pure varieties of fruit.) *Vinodelie Vinogradarstvo S.S.S.R.* (Wine-making Viticult. U.S.S.R.) No. 2, pp. 19-22. (Condensed from *Plant Breed. Abstr.*, **22,** p. 607.)
It is noted that the black currant varieties 15717, 15732 and 15830 were bred from 1024 × Goliath, and 15646 from Obiljnaja × Goliath.

706. Pavlova, N. M. 1927. (Synopsis of the literature of the genus *Ribes*.) *Bull. appl. Bot. Pl. Breed.*, **17,** pp. 463-513.

707. Pavlova, N. M. 1931. Summary of cytogenetic data on the genus *Ribes* L. *Bull. appl. Bot. Pl. Breed.*, **25**(5), pp. 104-19. (Condensed from *Plant Breed. Abstr.*, **2,** p. 150.)

The genus has been divided into the following groups: *Ribesia*, *Coreosma*, *Grossularioides*, *Grossularia*, *Parilla*, *Berisia*. Interspecific hybrids are known in each of these groups except *Grossularioides*, and also between members of different groups.

Interspecific hybrids display varying forms ranging from high fertility as in the case of *R. pallidum* Otto and Dietr. (*petraeum* × *rubrum*), *R. houghtonianum* Jancz. (*rubrum* × *vulgare*), and *R. gonduini* Jancz. (*petraeum bullatum* × *vulgare*), to complete sterility.

Cytological investigations have been made of 18 species and 9 hybrids belonging to 5 distinct subgenera. All are $2n=16$. Hybrids have so far not been observed in the wild state. Various attempts to find a cytological explanation of sterility are cited, followed by the discovery of the differences in size, then form, of the chromosomes of different species, of irregularities in the reduction division in sterile species, of allosyndesis detected in species whose parents differed in chromosome size and form, and the pollen irregularities consequent upon this. The sterility increases with the differences in size of the two chromosome sets. Cells containing only univalents divide regularly and may give diploid gametes.

A table is given showing the parentage of a large number of interspecific hybrids of *Ribes*.

708. Pavlova, N. M. 1934. (Classification of the species of red currant on a genetical basis.) *Bull. appl. Bot. Pl. Breed. Ser. 8* (2), pp. 87-119. (Condensed from *Plant Breed. Abstr.*, **6,** p. 83.)

A detailed review of the literature on classification of red currants is followed by a presentation of the author's results. Certain characters have proved useful in distinguishing the three main species, *Ribes vulgare*, *R. rubrum* and *R. petraeum*. These characters can be detected in hybrids of the respective species and from this it has been possible to assign a probable ancestry to the varieties, and establish a natural genetical classification.

709. Pavlova, N. M. 1935. (The gooseberry.) *Lenin Acad. Agric. Sci., Inst. Pl. Ind., Sci. Pop. Ser.* No. **53,** 120 pp. (Condensed from *Plant Breed. Abstr.*, **6,** p. 83.)

An historical and present day survey is followed by a botanical description of the genus and of its various species. A key is given for the determination of the 36 best commercial varieties. A large number of varieties are described and their reaction to *Sphaerotheca* and other ailments is discussed.

In a chapter devoted to breeding, the importance of producing varieties suited to different localities and resistant to *Sphaerotheca* is stressed. The results of earlier breeders are outlined, notably the successful use of American species for introducing *Sphaerotheca* resistance and other valuable qualities into the European gooseberry. Interspecific crossing is recommended as the most promising method of breeding and the most suitable species for various purposes are tabulated.

Pavlova, N. M. 1936. *See* **Bologovskaya, R. P., Katinskaya, J. K., Pavlova, N. M.,** and **Rozanova, M. A.**

710. Pavlova, N. M. 1940. (Initial material for the breeding and cultivation of bush fruits.) *Vestnik Socialističeskogo Rastenievodstva* (Soviet Plant Industry Record) No. 5, pp. 33-46.

The main breeding problems for each type of berry fruit, and the main features of the varieties and wild species suitable as initial material for breeding are outlined. Details are given of Russian and other varieties of black and red currants, gooseberries and raspberries with observations on their economic and nutritional value and on their potential value as parents.

Ribes

The black currant, Slava Leningrada, is resistant to fungal diseases and also to mite (due to compactness of the buds). Crosses of *R. dikuscha* Fischer with European varieties have produced promising hybrids, one of which is Primorsk Champion. Such forms are specially useful where frost resistance is needed. For drought resistance *R. americanum* Mill. is recommended, while for Central Asia, crosses of the American black currant with *R. nigrum* should be tried; the latter ripens earlier than the American and the berries do not fall so easily.

In breeding red currants for resistance to anthracnose the value of the large-fruited Siberian forms of *R. petraeum* Wulf. and some of its hybrids with European varieties are specially mentioned.

The sugar and vitamin C content of different varieties is recorded.

Reduction in the number of seeds is also a character that should receive attention from the breeder; several varieties are available with only 3-4 seeds per berry. The best of these is the variety 'Seedless'. *R. atropurpureum* C. A. Meyer, *R. palczewskii* (Jan.) Pojar, and *R. manshuricum* Komar. which occur in Asiatic Russia, are also of possible interest. An annotated list of varieties of interest to breeders is given.

For gooseberries, interspecific hybridization is thought to be the only method of producing an American type equalling the European in berry size and flavour.

The European gooseberry, *Grossularia reclinata*, has two main drawbacks, susceptibility to *Sphaerotheca* and poor rooting of cuttings. The American gooseberry is resistant to *Sphaerotheca* and easy to propagate, but the flavour and size of the fruit are poor.

Since 1933 six American species (*R. irriguum*, *robustum* (=*niveum*×*inermis*), *divaricatum*, *niveum*, *cynosbati*, *arcuatum*) and two Asiatic species (*G. acicularis* and *stenocarpum*) have been crossed with European varieties in Russia. F_1s of these crosses showed the following characteristics:

(*a*) Asiatic spp. × European—All F_1s susceptible to *Sphaerotheca*.

(*b*) American × European—Many *Sphaerotheca* resistant seedlings, resistance varying with the American species used, and with the European variety.

(*c*) F_1s were phenotypically like the wild parent.

(*d*) Fruit size of F_1s usually was intermediate between that of its parents.

(*e*) F_1s of *R. niveum* were highly susceptible to rust.

The best results were obtained from Lancer × *R. divaricatum* and *R. irriguum* × Lancashire Lad. Both crosses gave high yielding plants with compact growth and large fruit. *R. robustum* was also a good parent, as were *R. oxyacanthoides*, *R. lobbii*, and *R. hirtellum*.

The progenies of *R. cynosbati* were very poor.

Rubus

The World Collection of raspberries includes over 600 varieties.

The origin and distribution of the European and American raspberries are discussed.

Intervarietal crossing of the red species with its subspecies may give improved types, though such crosses are often sterile; this defect occurred in hybrids of European varieties with *R. idaeus* L. subsp. *melanolasius* Focke, found in Siberia and the Far East. Promising hybrids of red × black raspberry have been obtained but their poor frost, drought and anthracnose resistance makes them unpromising for northern regions.

Varieties recommended for breeding are:

For upright growth: Marlboro, Turner, King, Latham.

For winter frost resistance: Turner, Marlboro, King, Schwarbenstolz.

For drought resistance: Pyne's Royal, Lloyd George.

711. Pavlova, N. M. 1955. (Breeding black currants in the U.S.S.R.) *Agrobiology*, *Moscow*, No. 4, pp. 264-71. (Condensed from *Plant Breed. Abstr.*, **26**, p. 295.)

New varieties from Leningrad, the Altaĭ, Novosibirsk, and White Russia, are all distinguished by high yield and resistance to anthracnose, and some are hardy and tolerant of drought. They were obtained by distant hybrization, with a wild Siberian form or with selections from it.

712. Pearse, H. L., and **Garner, R. J. 1937.** A note on the use of α-naphthaleneacetic acid for rooting soft-wood cuttings of fruit tree stocks. *J. hort. Sci.*, **15**, pp. 248-51.

Immersion of the bases of cuttings of black currant for 12 hours in 30-40 p.p.m. α-naphthaleneacetic acid markedly stimulated rooting.

Peitersen, A. K. 1920. *See* **Brainerd, E. V.,** and **Peitersen, A. K.**

713. Peitersen, A. K. 1921. Blackberries of New England. Genetic status of the plants. *Bull. Vt agric. Exp. Sta.*, **218**, 34 pp. (Condensed from *Exp. Sta. Rec.*, **45**, pp. 641-2.)

This paper deals with (1) the effect of light, temperature and humidity upon the development of external characters, hairs, prickles, etc., and of light upon the habit of growth, and (2) a genetic analysis of the various species and forms under observation [cf. Darrow and Sherwood, 1932].

The development of outgrowths on the stem, such as prickles and hairs, was found to be little, if at all, influenced by humidity or temperature, but was markedly affected by light, the number of outgrowths increasing in direct proportion to the light intensity.

From various observations it was concluded that spontaneous hybridization is common in *Eubatus* and that a large number of so-called species are hybrids or cryptohybrids brought about by the interbreeding of elementary species.

714. Percival, M. S. 1946. Observations on the flowering and nectar secretion of *Rubus fruticosus* (agg.). *New Phytol.*, **45**, pp. 111-23.

Terminal flowers of *Rubus fruticosus* (blackberry) have an average life of 90 hrs as against 60 hrs for subterminals. There are two peaks in the blooming due to the opening of terminal and subterminal flowers respectively. Individual flowers, whether terminal or other, secreted on average 14·5 mg. of sugar. There is a diurnal rhythm in sugar secretion, the ratio

of day to night being 3: 1 for terminal flowers and 1·6: 1 for subterminal flowers.

Peren, G. S. 1922. *See* **Grubb, N. H.,** and **Peren, G. S.**

Perlmutter, F. 1943. *See* **Fischer, H. E., Darrow, G. M.,** and **Perlmutter, F.**

715. Petrov, D. F. 1939. On the occurrence of facultative pseudogamy in a triploid variety of raspberries, Immer Tragende (*R. idaeus*). *C.R. (Doklady) Acad. Sci. U.R.S.S.*, **22,** pp. 352-3. (Condensed from *Plant Breed. Abstr.*, **9,** p. 467.)

In the 3*x* raspberry, Immer Tragende (Ever-bearing), 2-3$_{iii}$, 4-5$_{ii}$ and 4-5$_{i}$ were observed in PMC's and up to 90% of the pollen was aborted. When emasculated and isolated the variety was sterile, but when pollinated with 2*x* Marlboro several plants were raised; these were identical with Immer Tragende and all had 21 chromosomes. When crossed with the 6*x* *Rubus loganobaccus* variety Texas, however, Immer Tragende gave true hybrids with 42 chromosomes, evidently the result of the fertilization of unreduced egg cells by normal pollen grains of Texas. Immer Tragende therefore produces egg cells with the somatic chromosome number which may develop apogamously or may be fertilized normally, according to which male parent is used. Macrosporogenesis has not yet been studied in the variety.

Pickett, B. S. 1934. *See* **Stoutemyer, V. T., Maney, T. J.,** and **Pickett, B. S.**

716. Pierson, R. K., and **Buchanan, T. S. 1938.** Age of susceptibility of *Ribes petiolare* leaves to infection by aeciospores and urediospores of *Cronartium ribicola*. *Phytopathology*, **28,** pp. 709-15.

The younger leaves were found to be the most susceptible to infection from both aecidiospores and uredospores. Leaf susceptibility remained high until about the time of size maturity (approximately 3 weeks after emerging from the buds). After reaching size maturity, increase in leaf age was accompanied by decrease in susceptibility.

717. Piper, C. V. 1897. An undescribed black-cap raspberry. *Erythea*, **5,** No. 10, p. 103.

Rubus hesperius is described as a new species from Washington.

718. Pitcher, R. S. 1948. Observations on the raspberry cane midge (*Thomasiniana theobaldi* Barnes) and its association with cane blight. *Rep. E. Malling Res. Sta. for 1947*, pp. 141-3.

Bath's Perfection, Newburgh and Malling Enterprise are susceptible to midge, whereas Landmark and Norfolk Giant are only lightly attacked.

719. Pitcher, R. S., and **Webb, P. C. R. 1949.** A fungus disease of raspberries induced by insect attack. *Nature, Lond.*, **163,** p. 574-5.

Normal splitting in the rind of the cane is more extensive in varieties showing higher susceptibility to raspberry cane midge attack (and therefore to the cane blight fungi which enter the cane through midge feeding lesions).

720. Pitcher, R. S. 1951. The raspberry cane midge and its control. *Rep. E. Malling Res. Sta. for 1950*, pp. 211-12.
A brief account is given of the raspberry cane midge (which is found only in the south and Midlands in Britain), and of the associated fungal invasion. Newburgh and Enterprise are susceptible, Norfolk Giant and Landmark very resistant.

721. Pitcher, R. S. 1952. Observations on the raspberry cane midge (*Thomasiniana theobaldi* Barnes). I. Biology. *J. hort. Sci.*, **27,** pp. 71-94.
An account is given of the biology of the raspberry cane midge including notes on distrib tion and external morphology. Natural splitting of the epidermis and outer cortical tissues of the cane provides shelter for eggs and larvae. The amount of such splitting is often the most important factor affecting varietal susceptibility to midge damage. Bath's Perfection, Newburgh and Enterprise show severe damage, Reader's Perfection and Lloyd George appear less susceptible and Norfolk Giant and Landmark are little affected.

722. Pohl, H. 1938. (Cane blight of raspberries.) *Obst- u. Gemüseb.*, **84** (3), pp. 32-3.
Harz Jewel appears to combine resistance to *Didymella applanata* with other desirable characters.

723. Pope, W. T. 1930. Report of the Horticultural Division. *Rep. Hawaii agric. Exp. Sta. (1929)*, pp. 3-22.
This report includes, on pp. 19-21, a description of the native Akala berry, of which two distinct species exist, *Rubus hawaiiensis* and *R. macraei*. *R. hawaiiensis* ranges up to 15 ft. in height with perennial stems 1-2 in. in diameter, strong, upright and unarmed after the first or second year's growth. The fruit is either dark purple or yellow and averages 1 in. in diameter, individual fruits measuring up to 2 in.

724. Popenoe, W. 1920. The Colombian berry or Giant Blackberry of Colombia. *J. Hered.*, **11,** pp. 194-202.
The Colombian Berry, thought to be *Rubus roseus*, grows in moist, cool conditions at elevations of nearly 10,000 ft in Colombia. The thorny canes grow partly scrambling and partly half erect, reaching 9-10 ft in length. The light crimson fruits are 1-2½ in. long and ¾-1½ in. broad. The torus is often eaten with the fruit but sometimes comes away readily.

725. Popenoe, W. 1921. The Andes berry. *J. Hered.*, **12,** pp. 386-93.
Rubus glaucus, the Andes berry, occurs at high altitudes in several countries and is cultivated in Colombia and Ecuador. In growth and foliage it resembles the black raspberry, but its fruit is blackberry-like, the receptacle being adherent to the fruit. The species is variable in size (up to 1½ in. long), colour (maroon, light red, pink), and quality of the fruits, which are not 'seedy'.

726. Popov, V. 1952. (New varieties of fruit trees and berries.) *Kolhoznoe Proizvodstvo* (Collective Farming), No. 6, pp. 59-60. (Condensed from *Plant Breed. Abstr.*, **23,** p. 125.)
Gooseberry. Of the seven varieties under trial, Russkiĭ, Plodorodnyĭ, Severnyĭ Vinograd, Pioner and Malahit are remarkable for their large fruits and resistance to mildew.

727. Porpáczy, A. 1944. (Crosses between raspberry and dewberry.) *Bull. Hung. Coll. Hort.*, **10**, pp. 143-5.

Raspberry × blackberry hybrids have been made in order to improve the flavour of the cultivated raspberry. The F_1 of Lloyd George × *R. caesius* was almost sterile. The reciprocal cross *R. caesius* × *R. idaeus* did not succeed. The F_2 was more fertile, with fruit more like the blackberry. Only in F_3 did a few raspberry types appear, but these were of no great value. The best F_2 plants were crossed with *R. loganobaccus* Bailey (*R. ursinus* × *R. idaeus*) as seed parent. The reciprocal cross failed. A wide range of types of good agronomic value were found in the F_1. They combined the fertility of the loganberry with the frost resistance of *R. pseudo-idaeus*. This new triple hybrid has been named *Rubus mohacsyanus* Porpáczy.

728. Porpáczy, A., and **Faragó, M. 1950.** (Blackberry-raspberry interspecific hybrids.) *Agrártud. Egy.*, **1**, pp. 3-9.

Line 6201, a selection from the F_1 of Lloyd George × *Rubus caesius* L., is highly fertile and high yielding with sweet, dark red, crumbly, 'bloomed' fruit. The other F_1 hybrids were wholly or partly sterile, but in F_3 and F_4 several fertile individuals arose. To reduce sterility and the crumbly character of the fruit, crosses were made between two of the hybrid lines (6201 and 6206) and *R. loganobaccus*.

The cross with 6201 gave a partially frost resistant individual in F_3. This was crossed with raspberry hybrid 401. The progeny of the other cross (6206) were more similar to *R. loganobaccus* and correspondingly more sensitive to frost. In the third generation of this latter cross many frost-resistant individuals were present, from which clones were propagated. The most promising clone was named *Rubus mohácsyanus* Porpáczy. The fruit of this clone is 2·5-3 cm. long and 1·5-2 cm. broad, dark red and of blackberry type.

729. Posnette, A. F. 1952. New virus diseases of *Ribes*. *Rep. E. Malling Res. Sta. for 1951*, pp. 133-5.

Vein banding of gooseberry, transmitted by the lettuce aphid, *Nasonovia ribis-nigri* (Mosley), is common on gooseberries in Kent. Open pollinated seedlings of Leveller developed symptoms one month after they had been infected by viruliferous aphids; open pollinated seedlings of Keepsake took 2-5 months.

Vein pattern disease of black currant was found on Baldwin and Wellington XXX. Although the disease was successfully transmitted by grafting, no insect vector has yet been found.

Black currant yellows, found on a plant of Seabrook's Black, was successfully transmitted, by grafting, to Baldwin and Wellington XXX. No insect vector has been found.

730. Potter, J. M. S. 1945. National fruit trials 1921-44. Roy. Hort. Soc. Lond., 56 pp.

Many of the soft fruit varieties dealt with here are described under Potter, 1951. Other varieties described are:

Black currants.—Martham Sunrise indistinguishable from Boskoop Giant. *Hatton Black* ripens with or a little after Seabrook's Black. Bushes are of medium vigour, compact and upright. Trusses are long with medium sized berries; a good cropper. *Supreme* ripens with or a few days before Baldwin. Bushes are large, erect and compact. Trusses are long and often

borne in pairs. Berries are large, acid and tough skinned. The yield has fallen off in recent years.

Red currants.—Wilson's Long Bunch remains the best mid-season to late variety. A number of poor cropping stocks received at Wisley under this name are off type.

Raspberries.—Red Cross ripens early with a fairly long picking season. Canes are numerous and erect. The fruit is large, firm, conical to round, bright red turning dull when fully ripe. This variety has been the most regular and consistent cropper at Wisley and has proved virus tolerant but is not suitable for all localities. *Norfolk Giant*, the latest variety, has numerous strong canes. The fruit is large, easily plugged and of fair flavour, not outstanding. The variety is highly resistant to virus infection but is sensitive when infected. *Taylor*—a mid-season variety—has numerous strong, erect canes. The fruit is small to medium, conical, rather dark and of poor flavour. A poor variety despite its vigour and virus tolerance.

A complete list of varieties maintained at Wisley is included.

731. Potter, J. M. S. 1948. National fruit trials 1945-7. Roy. Hort. Soc., Lond., 32 pp.

Raspberries.—Descriptions of eight raspberry seedlings raised at East Malling Research Station are given including 51/4 [V], 51/57 (W), 51/79 (Promise), 51/84 (Exploit) and 51/90 (Z). Two introductions raised by the U.S.D.A. (Slate) are Seedling 8475, and Milton. *Milton* is mid-season with plenty of moderately stiff canes of medium vigour. The fruit is medium-sized, roundish, bright orange-red, plugs easily but tends to crumble. Both Milton and Seedling 8475 have maintained vigour for 10 years, although growing in close proximity to virus infected stocks.

Black currants.—Varieties not described by Potter, 1945, 1951 or 1953 are: *O.P.21* which makes a medium to large bush of dense spreading habit. The fruit ripens evenly but the bunches are rather short and crowded at the nodes. The berries are medium sized, very acid, with tough skins. The mid-season variety *Laxton's Grape* is rather a weak grower at Wisley. The fruit has a thin, tough skin. Distal fruits are large, but size decreases towards the base of the strig. *P.S.24* is a moderately vigorous, mid-late season variety which makes a rather large, very spreading bush. Strigs are usually paired and contain about eight rather small, thick skinned berries which ripen unevenly. *Hawbings' Excelsior* produces a medium sized bush of rather poor vigour. It is very similar to Baldwin but the fruit ripens a few days earlier and is thinner skinned. *Nigger*, a variety quite distinct from Laxton's Nigger, is very similar to Goliath in all respects.

Notes on varieties of soft fruits in relation to jam manufacture.—Varieties of raspberries giving a better flavoured jam than most were Milton, Enterprise, and Norfolk Giant.

Black currant varieties satisfactory for jam are Boskoop Giant, Seabrook's Black, Laxton's Grape, Mendip Cross, Wellington XXX, Invincible Giant Prolific, Blacksmith, Cotswold Cross, Westwick Triumph, Westwick Choice, Daniel's September Black, and Baldwin.

732. Potter, J. M. S. 1951. National fruit trials 1921-50. Roy. Hort. Soc., Lond., 28 pp.

Black currants.—Few of the large number of black currant varieties tested show any improvement on the standard varieties Boskoop Giant

(early), Seabrook's Black (mid-season), Goliath (mid-season), and Baldwin (late).

The early varieties described are: *Mendip Cross*, raised at Long Ashton Research Station, has rather thin skinned fruit which does not hang well after ripening; it has been a fairly regular and heavy cropper at the National Fruit Trials [*see* Potter, 1953]. *Raven* ripens about a week after Boskoop and makes a rather straggling, sparsely branching bush. Trusses are long, single or paired and the berries are even and medium in size. The skin is of medium thickness and the flavour good, slightly acid. The variety may be slightly sulphur shy.

The second-early variety *Wellington XXX* is early-leafing and flowering. The bush is very vigorous and spreading and bears one, two or three trusses, of 7-8 berries each. The berry is medium to large, rather sweet with a tough skin and does not hang well. Generally a very heavy cropper under widely differing conditions. The variety is rather sensitive to lime-sulphur.

Midseason varieties are: *Davison's Eight*, which flowers rather early. The bush is of medium vigour and compact. The trusses are borne in twos or threes and contain about six berries. The berries are fairly large, thick skinned, of good quality and ripen evenly, but do not hang very well. The variety is very sensitive to lime-sulphur. *Westwick Triumph* is fairly late leafing but flowers early to midseason. The bush is moderately vigorous and spreading. The trusses are usually borne singly and contain 7-8 medium sized, tough skinned berries. The fruit hangs and travels well. The variety is very sensitive to lime-sulphur. *Invincible Giant Prolific*—there are two varieties under this name, one almost identical with Goliath and as sulphur shy, the other a very poor cropper. *Blacksmith* ripens a few days before Baldwin. It is vigorous and slightly spreading, making a large bush. The trusses are borne singly or in pairs and contain 7-10 berries. The berries are medium to large, of good flavour and colour, tough skinned and travel well. It is not sulphur shy and is one of the heaviest croppers ever received for trial. The variety is very similar to Tinker.

Later varieties are: *Baldwin (Hilltop)*, a selection from Baldwin, slightly more vigorous than the type. *Cotswold Cross* ripens with Baldwin and is moderately vigorous. It flowers early. The trusses are borne in pairs and contain 7-9 berries. The berries are medium sized at first, becoming smaller later, of good colour, thick skinned and travel well. The variety is not sulphur shy; not outstanding at Wisley. *Westwick Choice* ripens with Baldwin and is moderately vigorous and compact. The trusses are borne in twos or threes. The berry is medium to large, thick skinned and hangs well. *Wallace Seedling* is more or less identical with Baldwin. *Daniel's September* is probably a sport of Baldwin, but grows more vigorously and ripens about ten days later. Whole branches or bushes often revert to the Baldwin season of ripening. *Amos Black* ripens 7-10 days after Baldwin [*see* Potter, 1953].

Raspberries.—Descriptions of the following varieties are given: Promise (51/79); Exploit (51/84); Jewel (33/54); Notable (32/163); Newburgh, which is somewhat tolerant of virus but susceptible to cane midge and spur blight; Landmark (34/42), and Norfolk Giant.

Red currants.—Standard varieties for comparison with new types are Fay's Prolific (early) and Wilson's Long Bunch (midseason to late). Early varieties under test are: *Laxton's No. 1* which is vigorous and upright to slightly spreading. The berries are medium, firm, and bright red.

The variety crops regularly and heavily and is outstanding. *Earliest of Fourlands* ripens a few days after Laxton's No. 1 and makes very large erect bushes. The berries are large, firm, and bright red. A heavy cropper but rather susceptible to local conditions.

A botanical description of the midseason variety *Red Lake* is included and suggests it belongs to the Versailles group (*Ribes vulgare macrocarpum*) except for two anomalies. [For description of commercial qualities, *see* Potter, 1953.]

Gooseberries.—The standards used for comparison are Lancashire Lad (midseason) and Leveller (midseason). *Bedford Red* ripens just before or with Lancashire Lad, and is good for picking green or for dessert. The fruit is medium round, dark red, hairy and of good flavour. The habit of the bush is good and upright, but it does not crop as heavily as Lancashire Lad. *Bedford Yellow* ripens with Bedford Red and is a dessert fruit. The fruit is medium, round to oval and golden-yellow streaked red and of very good flavour. The bush is upright to spreading, a moderate cropper and sulphur shy. *Ingall's Prolific Red*, a dessert variety ripening 7-10 days after Leveller, is not outstanding. The fruit is large, oblong, tapering distinctly to stem and dull red. The bush is spreading. *Green Gem* is a heavy cropper, suitable for picking green or for dessert and makes an upright bush [*see* Potter, 1953]. It has cropped more regularly and heavily than any other variety in the trial.

Blackberries.—The standard variety is Himalayan Giant (midseason). *Bedford Giant* ripens about the end of July and has large trusses of very large, round, shining blackberries of good quality. However, mosaic infection has caused loss of vigour in this variety. *John Innes* ripens very late so that much of the fruit is often spoiled by frost. The plant is vigorous. Trusses are medium, bearing many berries of medium size which are not quite easy to pick and are of fair quality.

733. Potter, J. M. S. 1953. New varieties of fruit in the United Kingdom. *Rep. 13th int. hort. Congr.*, London, pp. 732-8.

Brief descriptions of the following are included:

Raspberries.—Promise, Exploit, Lloyd George.

Black currants.—*Mendip Cross*, an early variety which makes a medium-sized, cup-shaped bush; the trusses are usually borne singly, each having 8-10 berries of medium size. *Laxton's Giant* is a second early; it makes a moderate-sized bush with stiffly erect new growth; trusses are usually single, with 5-6 very large berries. *Wellington XXX* and *Cotswold Cross* [*see* Potter, 1951]. *Amos Black* is of moderate vigour; the trusses are usually single and contain 9-10 moderately large, sub-acid berries; it ripens 7-10 days after Baldwin and hangs very well.

Red currants.—*Red Lake* is outstanding, of medium vigour, fairly upright to spreading; the trusses are well exposed, about $4\frac{1}{2}$ in. long, with very large, bright coloured berries ripening midseason.

Gooseberries.—*Green Gem*, a dual purpose variety, ripens about a week after Leveller; the fruit is moderately large, round to oval, green and of good flavour.

Blackberry.—*Merton Early* ripens August-September, is moderately vigorous and bears heavy crops of large, well-flavoured berries. It is apomictic and comes true from seed.

Pratt, C. 1953-54. *See* **Einset, J., and Pratt, C.**

734. Pratt, C., and Einset, J. 1955. Development of the embryo sac in some American blackberries. *Amer. J. Bot.*, **42,** pp. 637-45.

The development of the embryo sac was studied in *R. allegheniensis* (2*x*), *R. canadensis* (3*x*), *R. localis* (3*x*), *R. bellobatus* (Kittatinny) (4*x*), *R. abactus* (5*x*), *R. meracus* (7*x*), and *R. flagellaris* (9*x*). Earlier breeding experiments had shown the diploid *Rubus* to reproduce sexually and the polyploids to be facultatively pseudogamous. The young ovule of all *Rubi* studied had a sub-epidermal layer of cells (archesporium), each cell of which divided once periclinally to form a parietal (outer, smaller) cell and a sporogenous (inner, larger) cell. The epidermal and parietal cells then divided repeatedly as the ovule grew. Several sporogenous cells could become megaspore mother cells. In *R. allegheniensis*, one of these underwent meiosis and an embryo sac with the reduced number of chromosomes regularly developed. In the polyploids, meiosis and reduced sacs were seen less often, particularly in the odd-ploid forms, and were very rare in *R. meracus*. Apospory was very rare in *R. allegheniensis*, but was common in the polyploids, particularly in the odd-ploids. Sacs with the somatic chromosome number could develop from sporogenous cells, sporogenous daughter-cells, parietal cells, and cells chalazal and lateral to the sporogenous cells. The origin of aposporous sacs could be determined only at the one-nucleate stage. The failure of ovules to produce a mature sac with a fully differentiated egg was more marked in odd-ploid *Rubi* than in the tetraploid and was even less conspicuous in the diploid. Non-functional ovules were characterized by arrested sporogenous cells, immature sacs, abnormal sacs, degeneration of the egg, the sac, or of the whole nucellus.

735. Prentice, I. W. 1950. *Rubus* stunt: a virus disease. *J. hort. Sci.*, **26,** pp. 35-42.

Rubus stunt attacks Phenomenal berry and loganberry (*Rubus loganobaccus*), Himalaya (*R. procerus*), Parsley-leaved blackberry (*R. laciniatus*), wild blackberry (*R. fruticosus*), raspberry (*R. idaeus*), purple cane hybrids, Boysenberry, Youngberry, Laxtonberry and Merton Early, causing the production of numerous weak canes. Different varieties of raspberry react somewhat differently to the disease. The disease spreads more rapidly in loganberry than in raspberry; it is graft transmissible, but no vector is yet known.

736. Prentice, I. W., and Harris, R. V. 1950. Mosaic disease of the raspberry in Great Britain. III. Further experiments in symptom analysis. *J. hort. Sci.*, **25,** pp. 122-7.

A disease, provisionally named curly dwarf, was identified by grafting from a symptomless Lloyd George carrier to Baumforth B. Curly dwarf is distinct from mosaic 2, American leaf curl, Canadian yellow blotch-curl, leaf curl in Scotland, and blackberry dwarf.

Norfolk Giant is a sensitive indicator of mosaic 2. Landmark and Malling Seedling B are symptomless carriers.

A new virus, as yet unidentified, was found in Red Cross.

737. Preston, A. P. 1955. A black currant variety trial. *Rep. E. Malling Res. Sta. for 1954*, pp. 78-81.

The main data from this paper are tabulated below:

Variety	*Flowers per strig (1945)*	*Percent berries set (1948)*	*Weight (g.) of shoots per plot affected by Botrytis (1946)*	*Gloeosporeum ribis grade (1947)**	*Order of picking (7-year average)*	*Total yield cwt./acre (7 years)*
Westwick Choice	11-13	42·1	17·7	2·0	5	191
Baldwin ..	11-15	38·5	30·3	3·3	6	183
Wellington XXX	15-17	37·6	24·0	2·1	3	258
Boskoop Giant ..	11-15	23·7	53·7	1·6	1	108
Goliath	9-11	41·8	24·9	1·1	4	156
Mendip Cross ..	11-15	51·5	13·3	1·3	1	173
Seabrook's Black	9-11	51·0	54·3	1·0	2	168

* 1=very little; 4=>¼ of leaves affected.

738. Prokofjev, S. D. 1953. (For high yields of small bush fruits.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 4, pp. 9-13. (Condensed from *Plant Breed. Abstr.*, **23,** p. 628.)
Five years' results from variety trials at the Moscow Research Breeding Station showed Latham to be the most productive raspberry. Severnaja Zvezda was the best red currant and Lija Plodorodnaja the best black. The small fruited gooseberry Carrie outyielded all other varieties.

739. Quick, C. R. 1938. Notes on the genus *Ribes* in California. *Madroño, S. Francisco,* **4** (8), pp. 286-90.
Observations on the distribution and morphology of native *Ribes* species are included.

Quick, C. R. 1944. *See* **Offord, H. R., Quick, C. R.,** and **Moss, V. D.**

Racicot, H. N. 1950-51. *See* **Bolton, A. J.,** and **Racicot, H. N.**

740. Rake, B. A. 1953. The propagation of gooseberries. I. *Rep. Long Ashton Res. Sta.*, pp. 79-88.

741. Rake, B. A. 1954. The propagation of gooseberries. II. *Rep. Long Ashton Res. Sta.*, pp. 63-8.

742. Rake, B. A. 1955. The propagation of gooseberries. III. The effect of time of taking and planting hardwood cuttings and the influence of buds on rooting. *Rep. Long Ashton Res. Sta.*, pp. 78-86.

743. Rankin, W. H., and **Hockey, J. F. 1922.** Mosaic and leaf curl of the cultivated raspberry. *Circ. Canada Dep. Agric., Div. Bot.*, **1,** 3 pp. (Condensed from *Rev. appl. Mycol.*, **1,** pp. 218-19.)
These two diseases have been included under the name 'yellows', but recent work has shown them to be distinct. Mosaic is serious in Cuthbert and Marlboro, but Herbert is only slightly affected except when grown adjacent to the other two. Marlboro and Herbert are rarely attacked by leaf curl.

Both diseases are spread by *Aphis rubiphila*. Herbert is believed to be avoided by these insects ordinarily, though they will pass to it when it grows near other varieties. The aphid is thought to be the only vector.

744. Rankin, W. H. 1926. Raspberry mosaic control in Hudson River valley. *Proc. N.Y. St. hort. Soc.*, **71,** pp. 173-8.
Failure of roguing as a control of mosaic in the Hudson River Valley is largely attributed to the use of the susceptible varieties Cayuga and Seneca for testing the method. The extended cultivation of the resistant varieties Cuthbert [cf. Rankin and Hockey, 1922], June, Ontario and possibly of Newman is recommended.

745. Rankin, W. H. 1927. Mosaic of raspberries. *Bull. N.Y. St. agric. Exp. Sta.*, **543,** 60 pp.
Mosaic is transmitted by *Aphis rubiphila* Patch. and by 1st and 2nd instar nymphs of *Amphorophora rubi* Kalt. On the basis of rate of spread from numerous uniformly arranged infection centres over a 3-year period, varieties were classified for klendusity as follows:

Immune or absolutely klendusic	*Highly klendusic*	*Slightly klendusic*	*Not klendusic*
Buckeye	Count	Brighton	Cayuga
Erskine Park	Eaton	Cuthbert	Golden Queen
La France	Goliath	June	Marlboro
Ohta	Herbert	Loudon	Owasco
Sunbeam	Jumbo	Lyerle	Seneca
Turner	King	Minnetonka	
Van Fleet	Latham	Newman	
Abundance	Miller	Ontario	
Shaffer	Ranere	Peerless	
Webster	Segrist	Cardinal	
	Syracuse	Columbian	
	Brant		

Klendusity is not necessarily correlated with virus resistance and varieties were classified for virus resistance on the basis of symptom expression as follows:

Immune or highly resistant	*Slightly susceptible*	*Moderately susceptible*		*Extremely susceptible*
Buckeye	Ranere	Eaton	Brighton	Count
Erskine Park	Latham	Goliath	Cayuga	Golden Queen
La France		June	Columbian	Herbert
Ohta		King	Cuthbert	Kevitt Hybrid
Sunbeam		Loudon	Empire	Owasco
Turner		Miller	Marlboro	
Van Fleet		Minnetonka	Marldon	
Webster		Ontario	Newman	
		Segrist	Peerless	
			Seneca	

Records of the rate of spread of mosaic from red to black raspberries in the field indicated that klendusity occurs in *R. occidentalis* also.

746. Rankin, W. H. 1927. Mosaic of red and black cultivated raspberries. *Phytopathology*, **17**, p. 46 (Abstr.).
The degree of control obtained by the use of mosaic-free planting stock and roguing is extremely variable in New York, being affected by such factors as the relative abundance of the vector *Amphorophora rubi* and the klendusity of the variety. Klendusity (escaping inoculation) and susceptibility are fixed factors in the different varieties and are not correlated.

747. Rankin, W. H. 1931. Virus diseases of black raspberries. *Tech. Bull. N.Y. St. agric. Exp. Sta.*, **175**, 24 pp.
The following names are recommended for the five virus diseases recognized: leaf curl alpha type; leaf curl beta type; severe streak; mild streak; red (raspberry) mosaic; yellow mosaic. The name 'mild mosaic' may be retained for a small dot-like type of mottling but its virus nature, if it is separable from red (raspberry) mosaic, is doubted. All the above except severe and mild streak occur on red raspberries. Five of the viruses occur on black raspberries, i.e. all except leaf curl alpha type.

Red mosaic expression is particularly affected by weather conditions. Cumberland is outstandingly resistant to this virus, but is particularly susceptible to leaf curl, while Plum Farmer appears resistant.

Inoculations showed that *Amphorophora rubi* can transmit red mosaic from red to black raspberries and from black to black; it can also transmit yellow mosaic from black to black.

The rate of spread of yellow mosaic, mild streak and red mosaic (including 'mild mosaic') is given for an experimental plot containing Ohio, Plum Farmer and Cumberland. Red mosaic was found to spread very rapidly and yellow mosaic slowly in all three varieties. Mild streak was found to spread very rapidly in Ohio but rather slowly in the other two varieties.

The 'mild mosaic' of Bennett (1927) is considered to be a phase of red mosaic.

Rankin, W. H. 1933. *See* **Slate, G. L.,** and **Rankin, W. H.**

748. Rehder, A. 1903. The truth about the strawberry-raspberry (*Rubus illecebrosus*). *Amer. Gdng*, **24**, p. 603.
R. illecebrosus, introduced into America from Japan about 1895, has attractive but rather insipid fruit. It grows readily in the northern States.

749. Reid, R. D. 1949. Soft fruits in Scotland. *Fruit Yearb.*, Roy. Hort. Soc. Lond., pp. 20-7.
Raspberries.—Lloyd George is a heavy yielding, all purpose berry and virus-free stocks from New Zealand are now available. Norfolk Giant often escapes spring frost damage through flowering late, but ripens late so that part of the crop may be lost. St. Walfried is one of the varieties most liable to spring frost damage.

Burnetholm Seedling is excellent for dessert but seldom thrives outside certain areas in Lanarkshire and Ayrshire. Landmark is too soft. Enterprise and J [Jewel] are of good canning quality.

Gooseberries.—Whinham's Industry is the most widely grown variety. It is very hardy and adapted to a wide range of conditions.

750. Resvoll, T. R. 1929. *Rubus chamaemorus* L. A morphological, biological study. *Nyt Mag. Naturv.*, **67**, pp. 55-129.

Richards, M. C. 1948. *See* **Yeager, A. F., and Richards, M. C.**

751. Riddelsdell, H. J. 1920. British *Rubi*, 1900-1920. *J. Bot., Lond.*, **58**, pp. 101-4.

752. Riddelsdell, H. J. 1923. Sudré's *Rubi Europae*. *J. Bot., Lond.*, **61**, pp. 75-7.

753. Riddelsdell, H. J. 1925. *Rubus*, in 'London catalogue of British plants', pp. 14-16, ed. by F. J. Hanbury, London.

754. Rietsema, I. 1936. (Mosaic disease of raspberries.) *Fruitteelt*, **26**, pp. 206-12.

In Holland certain raspberry varieties are less susceptible or less seriously damaged by mosaic than others.

A number of inbred lines have been obtained homozygous for berry size and partly so for fruit colour; in these plant height was not fixed and dwarfs occurred among the normals.

One strain from the family H. Br. (Haagsche Bruine) crossed with a strain of the family 112 [*see* Rietsema, 1939] yielded vigorous plants with large fruits of good colour, satisfactory flavour, and easily plugged, and all were free from mosaic.

Crossing is recommended in preference to inbreeding in obtaining commercial plants. In the course of a search for immune varieties, hybrids were obtained between *Rubus kuntzeanus* × *R. idaeus* and *R. phoenicolasius* × *R. idaeus*. These hybrids were practically immune to *Byturus*. They are specially suited for dessert, ripen in August and are high yielding. Crosses of the raspberry with the bramble or the black raspberry, with *Rubus spectabilis*, *R. odoratus*, or *R. illecebrosus* gave no seedlings of any value.

Rietsema, I. 1937. *See* **Ledeboer, M., and Rietsema, I.**

755. Rietsema, I. 1939. (A solution of the mosaic problem in raspberries.) *Landbouwk. Tijdschr.*, **51**, pp. 14-25. (Condensed from *Plant Breed. Abstr.*, **9**, p. 344.)

The writer suggests that a supply of constant inbred seedlings for use as planting material offers a solution to the mosaic problem. Some of the findings are given from genetic analyses begun in 1928 on various raspberry varieties including Pyne's Royal, Lloyd George, Haagsche Bruine and Strain No. 112 obtained by inbreeding the Devon variety. Fruit colour and size were among the characters studied and special attention was given to the effects of inbreeding on the production of dwarf, chlorotic, sterile and other abnormal forms. The author believes that by crossing inbred lines degeneration effects may be avoided and an adequate supply of young plants maintained which will be free from mosaic.

Rietsema, I. 1940. *See* **Ledeboer, M., and Rietsema, I.**

756. Rietsema, I. 1946. (Radboud and Gertrudis raspberries.) *Meded. Dir. Tuinb.*, pp. 387-90.

To solve the raspberry mosaic problem, raspberries have been inbred for several generations so as to obtain true-breeding large-fruited strains. The plants obtained were weak, but by intercrossing these inbred strains, vigorous healthy hybrids with large fruit were obtained. These have been named Radboud and Gertrudis.

757. Rietsema, I. 1955. (Interspecific hybrids in the genera *Ribes* and *Rubus*.) *Rep. 14th int. hort. Congr.*, Scheveningen, pp. 712-15.

Ribes

Rondom, from the cross (*R. multiflorum* ♀ × Versailles ♂) × *R. rubrum*, retains the *multiflorum* strig type and its resistance to late spring frosts and ripens about 14 days after most red currants. Rondom crops well and picking is easy. No marked improvement was shown by plants of the second backcross generation, which also retained the *multiflorum* strig type.

The cross Goliath ♀ × *R. divaricatum* ♂ gave plants identical with the male parent except for their larger fruit. The first backcross to Goliath as female parent produced two seedlings more vigorous than the F_1 plants, with larger fruit than either parent but in other respects identical with *R. divaricatum*. This 'spiny gooseberry with black fruits' has been named Brinio.

The F_1 of *R. rubrum* × *R. nigrum* was sterile as was that of *R. grossularia* × *R. nigrum*. As a tetraploid the latter hybrid was fertile, spineless and with a faint smell of black currant. The fruit was oval, borne in pairs, black and intermediate in size between that of the parents.

The cross Goliath × *R. bracteosum* produced one sterile seedlin backcrossing failed.

The following crosses failed: *R. nigrum* × *R. sanguineum*, *R. alpinum* × *R. rubrum*, *R. americanum* × *R. nigrum*, *R. nigrum* × *R. odoratum*, *R. rubrum* × *R. warscewiczii*.

Rubus

In general, crosses are easy to make between *R. idaeus* as one parent and *R. caesius*, *R. fruticosus*, *R. illecebrosus*, *R. innominatus*, *R. lasiostylus*, *R. loganobaccus*, *R. occidentalis*, *R. phoenicolasius* and *R. spectabilis*. The F_1 of *R. idaeus* × *R. occidentalis* is completely fertile, all the other F_1s only slightly so. Fertility is increased by backcrossing, but in the hybrids *R. idaeus* × *R. illecebrosus* and *R. idaeus* × *R. spectabilis* backcrossing failed. Backcrossing was successful in *R. idaeus* × *R. innominatus*, × *R. lasiostylus*, × *R. occidentalis* and × *R. phoenicolasius*.

Characters of the donor parent which are maintained in the backcross generations are:

the small size, colour and taste of the fruit of *R. phoenicolasius*;

the weakness of the peduncles, the ease of picking and firmness of fruit of *R. lasiostylus*;

the tendency to a purple fruit colour through lack of acidity and the ability to root from the cane tips of *R. occidentalis*.

Characters of the donor parent which disappear in backcross generations are, in the case of *R. lasiostylus*, the long dense hair on the drupelets and the whiteness of the canes.

Segregation for *idaeus* characters occurs in families from *R. idaeus* × *R. innominatus*. Heterosis may be maintained into the sixth generation.

None of the hybrids shows immunity to witches' broom [balai de sorcière].

Backcrossing in the hybrids *R. idaeus* × *R. caesius* and *R. idaeus* × *R. fruticosus* produced fertile plants of a bramble type.

758. Roach, F. A. 1955. Raspberry varieties. *Worcs. agric. Chron.*, **23**, 1, pp. 53-9.

A popular account dealing with Lloyd George, Norfolk Giant, Promise (regarded as tolerant to virus), Exploit (liable to wind damage because

of its long laterals), Malling V (not so subject to *Botrytis* as Exploit and Promise), Jewel and Enterprise (both moderately virus tolerant, apt to produce insufficient cane), Newburgh (very virus tolerant and regarded as being of better quality than most of the Malling sorts though liable to crumble), Milton and Taylor (both very virus resistant) and St. Walfried.

Robbins, R. C. 1939. *See* **Todhunter, E. N., and Robbins, R. C.**

759. Roberts, O. C., and Colby, A. S. 1943. Identification of certain red and purple raspberry varieties by means of primocanes. *Proc. Amer. Soc. hort. Sci.*, **42,** pp. 457-62.
The characters found to be of most value are the nature, colour and distribution of the prickles; cane colour, amount of bloom and pubescence; and shape of primary leaves. Secondary characters are number of leaflets; fold and rugosity of the leaves; nature of leaf margin; pubescence and number and structure of prickles on the petiole; and leaf 'pose'.

760. Rock, J. F. 1921. The Akala berry of Hawaii. Asa Gray's *Rubus macraei*, an endemic Hawaiian raspberry. *J. Hered.*, **12,** pp. 146-50.
Rubus macraei is a variable species which will have to be divided into several varieties, if not species. It is upright and spineless on the island of Kauai, smaller fruited and very spiny on Maui. The largest fruited specimens occur in the isolated small volcanic cone called Minakapanula at 6,000 ft elevation; this variety has fruits at least 2 in. in diameter and is totally spineless. Elsewhere both purple fruited and yellow fruited variants occur, the latter being the sweeter. The seeds are small.

761. Rogers, W. M. 1898. An essay at a key to British *Rubi*. West, Newman & Co., London, 56 pp., and *J. Bot., Lond.*, April 1892-Feb. 1893.

762. Rogers, W. M. 1900. Handbook of British *Rubi*. Duckworth & Co., London, 111 pp.

763. Rogers, W. M. 1903. *Rubi* of the neighbourhood of London. *J. Bot., Lond.*, **41,** pp. 87-97.

764. Rogers, W. M., and Linton, E. F. 1905. French and German views of British *Rubi*. *J. Bot., Lond.*, **43,** pp. 198-205.

765. Romanovskaja, O. I. 1955. (Mičurinist horticulturists in the Latvian S.S.R.) *Agrobiology, Moscow*, No. 4, pp. 350-2. (Condensed from *Plant Breed. Abstr.*, **26,** p. 296.)
Some new gooseberry varieties from Latvia show high yield, hardiness, *Sphaerotheca* resistance, good quality, and transportability. They were obtained from crosses of European varieties with *Sphaerotheca*-resistant forms from the U.S.A. (Houghton) or Finland (Pellervo); from crosses between European varieties and the wild species *Ribes rotundifolium*, *R. stenocarpum*, *R. gracile* and *R. cynosbati*; and by backcrossing or multiple hybridization involving the above material and also a local wild black currant.

766. Rose, R. C. 1919. After-ripening and germination of seeds of *Tilia*, *Sambucus* and *Rubus*. *Bot. Gaz.*, **67** (4), pp. 281-308.
Mixed seed of several varieties of *Rubus idaeus* contained about 40% with

no or with defective embryos. The *Rubus* endocarp consists of two layers: (1) an outer layer, variable in thickness, of lignified fibres longitudinally arranged in cross section of the fruit; (2) an inner region of 4 or 5 layers of lignified fibres transversely arranged in cross section of the fruit. The testa consists of 4 regions: (1) A layer of cushion-shaped cells with lignified walls; (2) 4 layers of collapsed cells with cellulose walls; (3) 1 layer of collapsed cells with thick, pectinized walls; and (4) 1 layer of cells with cellulose walls which appear as a thickened outer wall of the endosperm.

40% germination was obtained from *Rubus* seed buried for 140 days in the soil at 15-20° C. and 20% from seed stratified out of doors over winter for the same period. Dormancy is probably due to the strength of the endocarp and not to immaturity of the embryo. Seeds treated with concentrated H_2SO_4 for 2 hrs then thoroughly washed, germinate readily, the optimum temperature for germination being 20°-25° C. Seeds germinate equally well in light or darkness. Naked seeds germinate poorly in soil possibly due to bacteria or fungi.

A method for the germination of *Rubus* seed avoiding the necessity for stratifying is suggested: Remove seed from the pulp by fermentation in water or treating with a 5% solution of NaOH for 15-20 min., afterwards washing thoroughly. Dry the seeds for at least 24 hrs before treating them with concentrated H_2SO_4 for about 2 hrs. Wash in an excess of cold water and neutralize in a 5% solution of $Ca(HCO_3)_2$, then wash again.

767. Rozanova, M. A. 1928. (On the sexual dimorphism in *Rubus chamaemorus* L.) *Bull. appl. Bot.*, **19,** pp. 315-24.

Leaves of the female *R. chamaemorus* are longer and more deeply incised than those of the male plant which are more reniform, thus showing the same trend noted by Crane in hermaphrodite and male plants of *R. idaeus*.

768. Rozanova, M. A. 1932. (Results and prospects of scientific research in the field of small fruit growing.) *Bull. appl. Bot. Pl.-Breed.*, *Ser. A* (4), pp. 71-6.

769. Rozanova, M. A. 1934. (Modes of form genesis in the genus *Rubus*.) *J. Bot. U.R.S.S.*, **19,** pp. 376-84. (Condensed from *Plant Breed. Abstr.*, **6,** p. 81.)

Crosses between *Rubus caesius* (2n=28) and *R. idaeus* (2n=14) succeeded only when the latter was the female parent. Five hybrids were obtained; these differed morphologically from each other but all showed more resemblance to *R. caesius*. Only one fruited and this proved to be a tetraploid presumably resulting from the union of an unreduced egg with a normal pollen grain. In a second cross all the hybrids were similar and flowered abundantly but were sterile, being all triploids. Three F_2 seedlings were hexaploid (2n=42) and presumably arose from the union of unreduced gametes.

These 28 and 42 chromosome forms correspond in almost every respect to the species constituting the series *Sub-idaei*, suggesting a similar origin for the latter.

770. Rozanova, M. A. 1934. (Contribution to the question of geographical and ecological variation of characters as shown in the instances of several representatives of the genera *Rubus* and *Fragaria*.) *Bull. appl. Bot. Pl.-Breed.*, *Ser.* 8 (2), pp. 35-85. (Condensed from *Plant Breed. Abstr.*, **6,** p. 82.)

A survey of geographic variability in *Rubus* and *Fragaria* of fruit size, pubescence, and spines. In *Rubus* observations were made on *R. idaeus*, *R. saxatilis*, *R. arcticus*, and *R. caesius*. In *R. caesius* size of fruit varies little with either ecological or geographical differences; in the other species there was a fairly marked tendency for large fruits to occur in the Caucasus. The size differences proved heritable.

Degree of spininess and of pubescence varied considerably within each geographical group but with no regular geographical distribution in *R. caesius* and *R. arcticus*. In *R. saxatilis* and *R. idaeus* there was a slight increase of spininess and pubescence towards the east. The different degrees of spininess also proved heritable.

Rozanova, M. A. 1936. *See* **Bologovskaya, R. P., Katinskaya, J. K., Pavlova, N. M., and Rozanova, M. A.**

771. Rozanova, M. A. 1938. On polymorphic type of species' origin. *C.R. (Doklady) Acad. Sci. U.R.S.S.*, **18,** pp. 677-80.

Polymorphic species may arise where distinct races of parental species give rise, in parallel, to amphidiploids. They may also arise from species hybridization giving rise to other viable genome combinations as well as to amphidiploidy.

Putative genomes of seedlings derived from crossing *Rubus idaeus* (n=7) with different races of *R. caesius* (n=14) were:

ICC (2n=21): more or less sterile, F_1 hybrid.

IICC (2n=28): fertile F_1 of *R. idaeus* × *R. caesius* (Perm race); fertile F_2 [sic] from the cross (*R. idaeus* × *R. caesius* (Turkestan race)) × *R. idaeus*; fertile F_2 [sic] from the cross between the 28 chromosome F_1 hybrid and *R. idaeus*.

ICCCC (2n=35): more or less fertile hybrid from (*R. idaeus* × *R. caesius* (Perm race)) IICC × *R. caesius*, and from (*R. idaeus* × *R. caesius* (Turkestan)) ICC × *R. caesius*.

IICCCC (2n=42): fertile amphidiploid from the F_2 of *R. idaeus* × *R. caesius* (Turkestan race).

In the above hybrids, the amphidiploids and the 28-chromosome hybrids from *R. idaeus* × *R. caesius* (Perm race) were very similar to *R. maximus* Marsson; the other hybrids also resembled the series *Sub-idaei* (to which *R. maximus* belongs). These crosses thus explain the origin and polymorphism of the series *Sub-idaei*. In nature the series *Sub-idaei* is found in S. Sweden, Denmark, and N. Germany, i.e. where *R. idaeus* and *R. caesius* are sympatric so that natural hybridization is favoured.

772. Rozanova, M. A. 1938. (Hybridization within the genera *Rubus* and *Fragaria* as related to problems of form-genesis.) *Bull. Acad. Sci. U.R.S.S., Ser. Biol.*, pp. 667-79.

This paper covers much the same data as the previous one.

773. Rozanova, M. A. 1939. Evolution of cultivated raspberry. *C.R. (Doklady) Acad. Sci. U.R.S.S.*, **24,** pp. 179-81. (From *Plant Breed. Abstr.*, **10,** p. 55.)

Cultivated raspberries differ from the wild species *Rubus vulgatus* and *R. strigosus* (both of which belong to the conspecies *R. idaeus*) in their larger fruit size, greater polymorphism, larger number of recessive types, the presence of triploid (2n=21) and tetraploid (2n=28) types, and in being self-fertile. They have arisen relatively recently as a result of hybridization and selection.

774. Rozanova, M. A. 1939. Role of autopolyploidy in the origin of Siberian raspberry. *C.R.* (*Doklady*) *Acad. Sci. U.R.S.S.*, **24,** pp. 58-60.

The Siberian race of raspberries, *Rubus idaeus* subsp. *melanolasius* Focke, the Sakhalin race, subsp. *sachalinensis* Léveillé, the Kamchatka race, subsp. *sibiricus*, Komarov, and possibly also the north-western American race, subsp. *melanolasius* Focke, are all tetraploids while the European race *R. idaeus* subsp. *vulgatus* Arrhen., and the north-eastern American race subsp. *strigosus* are diploids.

On morphological grounds, the author considers the Siberian, Sakhalin and Kamchatka races should be included in the one species *Rubus sachalinensis* Léveillé.

An analysis of meiosis in *R. sachalinensis* PMC's showed the usual picture for autopolyploids with usually 3_{iv} at diakinesis, indicating genome homology as regards at least three chromosomes. In spite of certain irregularities at first anaphase, 14 chromosomes pass to each pole, and the percentage of abnormal pollen ranges only from 3% to 32%. As the fertility of *R. sachalinensis* is quite low, it is assumed that meiotic irregularities during macrosporogenesis are even more marked.

Up to 7_{iii} were seen at metaphase I in the F_1 triploid hybrids of *R. idaeus vulgatus* crossed with *R. sachalinensis*. This confirms the homology of the *R. sachalinensis* genomes. The hybrids were 95-98% pollen sterile.

The author considers that *R. sachalinensis* is an autopolyploid derived from *R. strigosus* which it resembles morphologically, and that it may have arisen under mountain conditions in eastern Asia or north-western America.

On the basis of morphology and distribution it is suggested that *R. vulgatus* and *R. strigosus* should be regarded as independent species derived from the initial type *R. idaeus* L.

775. Rozanova, M. A. 1940. On genotypic differences between races of *Rubus caesius* L. *C.R.* (*Doklady*) *Acad. Sci. U.R.S.S.*, **27,** pp. 590-3.

Cytological studies are described which determine the cause of amphidiploidy in the F_2 when *R. idaeus* is crossed with the Turkestan race of *R. caesius* and its absence when *R. idaeus* is crossed with other races of *R. caesius*.

Meiosis in PMC's of the 21 chromosome hybrid *R. idaeus* × *R. caesius* var. *turkestanicus* was very irregular. At diakinesis there were 7_{ii} and 7_i and one or two ring bivalents occurred in 12% of the cells. Distribution of chromosomes at the poles at late anaphase I was irregular and some chromosomes were lost. In the second division chromosomes were again sometimes lost and formed micronuclei. In one cell, all 21 chromosomes were included on one metaphase plate.

In the second division, cases were observed of the formation of a single broad spindle, of partial 'fusion' of two spindles, and of the formation of three spindles, and distribution of chromosomes to the poles was very irregular. Some dyads were formed, and 94-98% of pollen was abnormal.

The occurrence of single spindles at the second division and of second metaphase [plates] with 21 chromosomes suggests that a restitution nucleus may have been formed or that a pseudo-homeotypic division may have occurred.

The meiosis of the completely sterile F_1 hybrids *R. idaeus* × *R. caesius* (Perm and Luga races) was slightly less irregular, again with 7 bivalents

and 7 univalents at diakinesis but with one or two ring bivalents in 60% of the cells and a complete absence of 'fusion' spindles and of single spindles at second division. No dyads were seen.

The greater irregularity of meiosis in the hybrids with the Turkestan race of *R. caesius* suggests that this race is more remote from *R. idaeus* than are the European races of *R. caesius* and that this remoteness favours amphidiploidy.

776. Rozanova, M. A. 1940. Autosyndesis in the genus *Rubus*. *C.R.* (*Doklady*) *Acad. Sci. U.R.S.S.*, **29,** pp. 143-5.

R. idaeus L. (n=7) crossed with *R. caesius* var. *turkestanicus* Regel (n=14) gave a very slightly fertile triploid hybrid which when backcrossed to *R. idaeus* gave one slightly fertile tetraploid (n=14) plant. At diakinesis in this plant, 14_{ii} were usually formed; occasionally $1\text{-}2_{iv}$ were seen, but no univalents. In 52% of cells one or two ring bivalents (with two terminal chiasmata) were seen, the remainder having only one chiasma. At anaphase I, a few lagging chromosomes were seen and at anaphase II the chromosomes were often scattered along the spindle so that the gametic chromosome number was variable. However, 67% of pollen was normal.

On the assumption that the 28 chromosome hybrid included a diploid set of *R. idaeus* chromosomes and a haploid set of *R. caesius* chromosomes, the following deducations were drawn:

The high percentage of ring bivalents in the tetraploid hybrid compared with the 12% found in the triploid suggests that homologous *R. idaeus* chromosomes paired in the tetraploid and that therefore the *R. caesius* chromosomes must have paired autosyndetically. The formation of quadrivalents necessitates the conjugation of two homologous *R. idaeus* chromosomes with two chromosomes from the haploid set of *R. caesius*. The fairly high percentage of normal pollen and the fertility of the hybrid also suggest that autosyndesis has occurred.

As quadrivalents are never observed at meiosis of the various races of *R. caesius*, and as *R. caesius* is fully fertile, and both auto- and allosyndesis occur in *R. idaeus* × *R. caesius* hybrids, it is concluded by the author that the genomes of *R. caesius* are not homologous. Since autosyndesis is possible, the difference between the genomes must be due to gene mutations rather than to structural changes. On these grounds the two *R. caesius* genomes are designated C_1 and C_2.

Noting the fact that bivalent formation is common in meiosis of hybrids from distant crosses within the genus *Rubus*, it is concluded that gene mutations rather than structural chromosome changes have played the major role in the evolution of genomes.

777. Rozanova, M. A. 1941. (Distant hybridization within the genus *Rubus*.) *Vestnik Gibridizacii* (Hybridization) No. 2, pp. 21-50. (Condensed from *Plant Breed. Abstr.*, **14,** pp. 330-1.)

A detailed review is given of the author's extensive work on crossing species belonging to different sub-genera of the genus *Rubus*. All crosses between species of the sub-genus *Idaeobatus* and sub-genus *Cylactis* failed except *R. vulgatus* × *R. xanthocarpus* and *R. illecebrosus* × *R. xanthocarpus*.

The only combination of *Idaeobatus* × *Anoplobatus* that set seed was *R. illecebrosus* × *R. odoratus*; the hybrid was fully fertile and on account of its spectacular flowers is of interest as an ornamental plant.

The only *Idaeobatus* × *Chamaemorus* cross was *R. vulgatus* × *R. chamaemorus*, which set no seed whatever.

In the combination *Idaeobatus* × *Eubatus* several crosses were made, *R. vulgatus* × *R. caesius* receiving the most attention. Several forms with increased chromosome numbers were obtained from this combination, including types with 28, 35 and 42. The 28 and 42 chromosome hybrids are extremely fertile but require further improvement as regards quality.

A number of crosses were made between the subgenera *Cylactis* × *Anoplobatus*, *Cylactis* × *Chamaemorus* and *Cylactis* · *Eubatus* but seeds were obtained only from one combination *R. caesius* × *R. xanthocarpus*; the hybrid had 21 chromosomes and was sterile. The combinations *Anoplobatus* · *Chamaemorus*, *Anoplobatus* × *Eubatus* and *Chamaemorus* × *Eubatus* were also unsuccessful.

Interspecific crosses within the individual subgenera were more successful and a number of them are described. Promising commercial hybrids have already been selected from crosses of the variety English (*R. vulgatus*) with the American variety King (*R. strigosus*). Crosses of *R. occidentalis* × *R. vulgatus* have given a number of very fertile hybrids which are equal to the American varieties Cardinal and Haymaker in yield; they are, however, insufficiently resistant to frost. The F_2 segregations suggest that fruits of varying quality should be obtainable in the F_2 of this cross, where the *R. occidentalis* parent has a good preserving quality and the *R. vulgatus* parent good flavour.

A full report is given on the cytological behaviour of the different groups of hybrids. It is concluded that the most promising crosses are those between the raspberries (*Idaeobatus*) and dewberries (*Eubatus*) where fertile hybrids may be produced by amphidiploidy. The sub-genus *Chamaemorus* is the farthest removed from all the rest and failed to cross with any of them. When species or races of equal chromosome number within the sub-genus are crossed the hybrids are easily obtained and are completely fertile. When distantly related species of the same chromosome number are crossed the hybrids are sterile. On crossing nearly related species of different chromosome number sterile hybrids are obtained.

An analysis of the F_1 of different crosses shows that very few characters retain their dominance in all crosses. Most characters are intermediate in inheritance with deviations towards either one parent or the other. In hybrids of *R. vulgatus* × *R. caesius* the expression of a character is directly related to the proportion of the genomes of the parent forms in the hybrid. In breeding spineless raspberries it is necessary to bear in mind that, in crosses between spined and spineless forms, spineless segregates may appear only in the second and third generations.

778. Rozanova, M. A. 1945. (On some species, subspecies and varieties within the conspecies *Rubus idaeus* L.) *J. Bot. U.R.S.S.*, **30,** pp. 44-8. (Condensed from *Plant Breed. Abstr.*, **15,** p. 364 and **17,** p. 476.)

By applying ecological and geographical principles in establishing lower systematic units in the collective Linnaean species *R. idaeus*, the author concludes that *R. komarovi* Nakai. is a subspecies of *R. sachalinensis* (2n = 28), that variety *simplicior* Brenner. is a hybrid of *R. vulgatus* (2n = 14) × *R. caesius*, which cannot therefore be given any systematic rank, and that the Caucasian-highland form of *R. vulgatus* differs in many characters including frost resistance and large fruits and should be established as a distinct subspecies, *R. vulgatus* subsp. *buschii* Roz.

Ruehle, G. D. 1950. *See* **Cobin, M.,** and **Ruehle, G. D.**

779. Rusanov, N. M. 1950. (Horticulture in Karaganda province.) *Agrobiology, Moscow*, No. 1, pp. 108-15. (Condensed from *Plant Breed. Abstr.*, **20,** pp. 547-8.)
It is noted that a hardy local wild black currant is grown between rows of other fruits to trap the snow. The recently selected Dolinskiĭ Rozovyĭ gooseberry, which is resistant to *Sphaerotheca*, is being reproduced from seed.

Ruxton, J. P. 1953. *See* **Modlibowska, I.,** and **Ruxton, J. P.**

780. Ruxton, J. P., and **Modlibowska, I. 1954.** Preliminary studies on the resistance of raspberry varieties to spring frosts. *Rep. E. Malling Res. Sta. for 1953*, pp. 111-17.
Preliminary laboratory investigations showed that none of the varieties tested was markedly resistant although some, notably Norfolk Giant, tended to be less damaged than others. Open flowers were more damaged than buds.

781. S . . ., I. 1940. (New varieties of gooseberries.) *Land u. Frau*, **24,** p. 33. (Condensed from *Plant Breed. Abstr.*, **11,** p. 321.)
Mauks Früheste Rote and Lauffener Gelbe are sulphur resistant. The first named is a red berried form from a May Duke seedling, but 10-12 days earlier than May Duke. The second is a seedling of Pilot and it stands transporting well. Both are suitable for dessert and for jam.

782. Salmon, E. S., and **Wormald, H. 1921.** Varietal resistance to American gooseberry mildew in red currants. *Gdnrs' Chron.*, **70,** p. 47.
An unusually severe outbreak of gooseberry mildew was followed by the appearance of this mildew on certain varieties of red currant. A variety, supposedly Raby Castle, showed both perithecial and conidial stages. Fay's Prolific was immune.

Sando, C. E. 1920. *See* **Hawkins, L. A.,** and **Sando, C. E.**

783. Saunderson, W. R., and **Cairns, H. 1937.** On the control of gooseberry rust. *Ann. appl. Biol.*, **24,** pp. 17-25.
Observations in Northern Ireland on over twenty varieties of red, green, and yellow gooseberry revealed no pronounced variation in their susceptibility to rust (*Puccinia pringsheimiana*).

784. Sax, K. 1931. Chromosome numbers in the ligneous Saxifragaceae. *J. Arnold Arbor.*, **12,** pp. 198-206.
In the genus *Ribes*, all species examined have the same chromosome number and mutation seems to have been the basic factor in causing variation, although it is possible that structural changes have occurred in the chromosomes.

785. Schaub, I. O., and **Baver, L. D. 1942.** Research and farming. *Rep. N.C. agric. Exp. Sta.*, **65,** 92 pp.
Rubus glaucus has been successfully crossed with Youngberry, St. Regis [Ranere] raspberry and Cumberland black raspberry.

786. Schellenberg, H. C. 1923. (The susceptibility of *Ribes* species to white pine blister rust.) *Schweiz. Z. Forstw.*, **74,** pp. 25-50. (Condensed from *Rev. appl. Mycol.*, **2,** p. 483.)

Taking 10 as representing the highest susceptibility to *Cronartium ribicola* and 0 as immunity, the species are classified as follows: *Ribes nigrum* 10; *R. petraeum* 9-10; *R. alpinum* 7-9; *R. uva crispa* 6-8; *R. grossularia* 2-8; *R. aureum* 5-7; *R. rubrum* 2-4.

R. nigrum exhibited no varietal differences in degree of attack while *R. grossularia* varies considerably in susceptibility. Klebahn's theory that the stock in grafted bushes exerts an influence on the susceptibility of the scion, was not confirmed.

R. rubrum appears to be exceedingly resistant even in the immediate vicinity of heavily infected black currants. This statement applies primarily to the Dutch red currant; Versailles and the white and striped varieties are also resistant, but slightly less so than the Dutch.

Both *R. sanguineum* and *R. gordonianum* are very susceptible, while *R. aureum* is intermediate in susceptibility between these and *R. rubrum.*

787. Schipper, W. W. 1931. (Description of indigenous intermediate *Rubus* hybrids VII-VIII.) *Ned. kruidk. Arch.*, **3,** pp. 510-16, 580-4.

788. Schmidt, M. 1935. (Crosses between *Ribes* species.) *Rhein. Mschr. Obstb.*, **28,** pp. 292-3. (Reported by Nilsson, F., 1955.)

It is suggested that the Worcesterberry is identical with Jochelbeere produced by E. Bauer by crossing the gooseberry with *Ribes succirubrum.*

789. Schmidt, M. 1948. (Achievements and aims in fruit breeding.) *Züchter*, **19,** pp. 135-53.

The author describes methods of breeding for frost resistance and disease resistance in top and soft fruits.

American gooseberry mildew resistant N. American varieties 'Gebirgsstachelbeere' (*R. grossularia* × *R. cynosbati*), Downing (*R. gracile* × *R. grossularia*) and Houghton (*R. grossularia uva-crispa* × *R. oxyacanthoides*) are all small fruited and poor croppers. Gruber at Müncheberg has raised resistant F_2 seedlings from crosses between European cultivated varieties and the N. American species *R. divaricatum*, *R. succirubrum*, *R. pinetorum*, and *R. oxyacanthoides*. Backcrossing these to European varieties has given rise to resistant seedlings with good fruiting qualities and some drought resistance.

Two strains of *Gloeosporium ribis* have been isolated; one attacks gooseberries, the other red currants. *R. alpinum* proved resistant and some fairly resistant gooseberry seedlings were selected. *R. petraeum* hybrids showed some resistance.

The raspberry variety Latham was found to be resistant to *Didymella applanata* and *Coniothyrium fuckelii.*

790. Schmidt, M. 1952. (Crosses between currant and gooseberry species.) *Dtsch. Baumschule*, **10,** pp. 280-3.

The variety Heinemanns Rote Spätlese arose from the cross Holländische Rote × *Ribes multiflorum.*

Seedlings of the 'second generation of crossing' cultivated gooseberries with *R. divaricatum*, *R. succirubrum*, and *R. oxyacanthoides* have varied widely in growth habit, leaf type, spininess, size, colour and shape of the fruit. They are usually vigorous, easy to propagate by cuttings, and heavy

cropping. Strigs are usually 2-3 fruited, and the fruit is dark red or black with a high pectin content.

Plants from the cross cultivated gooseberry × *R. succirubrum* with small black currant-like fruit have been named Jochelbeeren by E. Bauer. Worcesterberry is considered to be of similar origin.

Spineless, pollen-sterile seedlings were obtained by crossing the black currant Langtraubige Schwarze with the gooseberries Grüne Flaschenbeere and Lady Delamere. No seeds were obtained from backcrossing or selfing these plants, although occasional parthenocarpic fruits were set.

791. Schwartze, C. D. 1934. The genetic constitution of certain red raspberry varieties in relation to their breeding behaviour. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 113-16.

Lloyd George proved the best parent for fruit size, being almost or completely homozygous for large long fruit. Cuthbert proved the best parent for transmitting flavour, though Lloyd George transmits high acidity to its progeny, while for colour of the fruit the best were the homozygous varieties Latham, King, Antwerp, and Marlboro. Lloyd George was found to be a homozygous hermaphrodite. Cuthbert × Lloyd George gave 241 red and 33 yellow plus apricot fruited seedlings. Cuthbert, Latham, King, Antwerp, and Marlboro were all heterozygous for sex. Victory selfed gave 7 red and 5 yellow or apricot seedlings.

792. Schwartze, C. D. 1935. Further observations on Lloyd George red raspberry as a parent in breeding. *Proc. Amer. Soc. hort. Sci.*, **32,** pp. 411-15.

Cuthbert × Lloyd George and Latham × Lloyd George both gave a large percentage of seedlings with desirable fruit shape, but other crosses do not support the writer's earlier (1934) contention that Lloyd George is homozygous dominant for fruit shape. These two crosses also gave the highest percentage of large fruited seedlings. A high proportion of well flavoured seedlings resulted from several crosses in which Lloyd George or Cuthbert were involved.

793. Schwartze, C. D., and **Huber, G. A. 1937.** Aphis resistance in breeding mosaic-escaping red raspberries. *Science*, **86,** pp. 158-9.

Antwerp, Herbert, and Newburgh showed marked resistance to *Amphorophora rubi*; Lloyd George proved immune, aphids being unable to maintain themselves on it. Chief, Viking, and Latham proved susceptible. Lloyd George, though mosaic susceptible, escapes infection in Western Washington because of its resistance to *A. rubi*; this resistance is transmitted in crosses with susceptible varieties. Of 31 reciprocal hybrids between Lloyd George and Cuthbert 6 proved immune and several others highly resistant. Of 6 hybrids between Lloyd George and Latham, 3 were resistant and 3 susceptible. All of 19 hybrids between susceptible parents were susceptible. It is suggested that the resistance lies in lack of suitable food for the aphid rather than in the presence of repellant substances.

Schwartze, C. D. 1938. *See* **Huber, G. A.,** and **Schwartze, C. D.**

794. Schwartze, C. D. 1938. The Washington and Tahoma red raspberries. *Pop. Bull. Wash. St. agric. Exp. Sta.*, **153,** 10 pp.

Washington derives from Cuthbert × Lloyd George, and Tahoma from Lloyd George × Latham. Both show vigour and winter hardiness. The

susceptibility of Cuthbert to winter killing was found to be due to the short resting period of its buds.

795. Schwartze, C. D., and **Huber, G. A. 1939.** Further data on breeding mosaic-escaping raspberries. *Phytopathology*, **29,** pp. 647-8.

Data for *Amphorophora rubi* resistance tests based on five potted suckers from each seedling are given:

Parent	*No. of seedlings tested*	*Resistant*	*Somewhat resistant*	*Susceptible*
		%	%	%
Cuthbert (Susceptible) ..	8	0·0	0·0	100·0
Lloyd George (Resistant)	50	72·0	12·0	16·0
WSC22 × Lloyd George ..	31	64·5	6·5	29·0
WSC43 × Lloyd George ..	45	80·0	2·2	17·8

WSC22 is a 'somewhat resistant' plant selected in a selfed family of Lloyd George. WSC43 is the resistant F_1 combination Lloyd George × Cuthbert. All the individuals noted are in addition to those previously classified (1937).

Aphid counts in the field agreed closely with results of greenhouse experiments.

It is considered that Lloyd George carries two or more dominant resistance genes.

796. Schwartze, C. D. 1945. Breeding raspberries for hardiness and disease resistance. *Bull. Wash. St. agric. Exp. Sta.*, **470,** pp. 61-2, 128.

Taylor transmits large berry size to some of its seedlings but is inferior to Cuthbert and Washington in transmitting high flavour.

2,505 inbred seedlings were tested for resistance to the mosaic vector, *Amphorophora rubi*, and certain selections proved homozygous for resistance. These will transmit resistance to all their offspring.

797. Schwartze, C. D. 1947. New small fruits for processing. *Fruit Prod. J.*, **26,** pp. 170-2, 189.

A review of recent breeding work in America.

798. Schwartze, C. D., and **Myhre, A. S. 1953.** The Puyallup red raspberry. *Circ. W. Wash. St. agric. Exp. Sta.*, **238,** 4 pp.

Puyallup, from Washington × Taylor, has large, firm fruit of a good colour, suitable for canning, freezing and dessert. The plant is vigorous and thorny and has a slight tendency to tip fruiting in late autumn. It is believed to be immune to western yellow rust, but has been affected slightly by anthracnose, spur blight and powdery mildew. The variety is susceptible to aphids. It appears to be adapted to a fairly wide range of soil conditions and is less affected by bud damage than Washington and Willamette.

Scott, D. H. 1954. *See* **Morrow, E. B., Darrow, G. M.,** and **Scott, D. H.**

799. Scott, D. H., and **Darrow, G. M. 1954.** Brambles: newer varieties resistant to disease are winning attention. *Amer. Fruit Gr*, **76** (1), pp. 36-8.

Latham is the leading red raspberry in the East, and although Taylor and Milton acreages are increasing neither variety is as winter hardy as Latham; moreover, Taylor is susceptible to viruses. Cumberland and Logan are the leading black raspberries, but Bristol and Dundee are increasing. Eldorado is the leading cultivated blackberry in eastern U.S.; Lawton is important in Oklahoma, and Early Wonder in Texas. On the west coast Willamette and Washington have replaced the older red raspberry varieties.

Purple Autumn was the first purple-fruited fall-bearing raspberry to be introduced. The red raspberry, Mandarin, is noteworthy for its heat tolerance and disease resistance; Manteo is a heat tolerant black raspberry.

800. Sergeeva, K. D. 1952. (The seed viability and plant vigour of gooseberry and currant hybrids.) *Agrobiology*, *Moscow*, No. 4, pp. 123-5. (Condensed from *Plant Breed. Abstr.*, **23**, p. 131.)

Davison's Eight × Lija Plodorodnaja produced more viable seed and more vigorous F_1 plants when the female parent was pollinated with a large rather than a small amount of pollen.

Healthy hybrids were obtained when Poorman gooseberry was pollinated with a pollen mixture of gooseberry hybrids showing resistance to *Sphaerotheca* or mixed pollen of Finik+Zelenyĭ Butyločnyĭ (Green Bottle)+Rannii Geningsa (Henings' Early)+Maĭskiĭ Gercog (May Duke).

801. Sergeeva, K. D. 1952. (Russkiĭ, a new gooseberry variety resistant to *Sphaerotheca*). *Sad i Ogorod* (Fruit and Veg. Gdns), No. 6, p. 74. (Condensed from *Plant Breed. Abstr.*, **23**, p. 131.)

Russkiĭ was obtained by pollinating Careless with mixed pollen of *Sphaerotheca* resistant types. The initial shortcomings of the variety (e.g. malformed fruits and prostrate habit) have been largely overcome by Mičurinite training.

802. Sergeeva, K. D. 1953. (*Sphaerotheca* resistant, black fruited forms of gooseberry.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 9, pp. 67-8. (Condensed from *Plant Breed. Abstr.*, **24**, p. 281.)

At Mičurinsk, productive, hardy and vigorous hybrids resistant to *Sphaerotheca* and bearing small black fruits of good quality were obtained by pollinating a hybrid between two unspecified wild gooseberries with mixed pollen of three gooseberry varieties. Some hybrids were almost spineless.

803. Sergeeva, K. D. 1954. (Fruit and seed formation in gooseberry seedlings in relation to their pollinators.) *Agrobiology*, *Moscow*, No. 2, pp. 144-6. (Condensed from *Plant Breed. Abstr.*, **24**, pp. 627-8.)

The fruit quality of the *Sphaerotheca*-resistant hybrid 55-6 was improved when plants were pollinated by large fruited varieties or with certain pollen mixtures.

804. Sergeeva, K. D. 1954. (Altaĭ varieties of black currant at Mičurinsk.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 6, pp. 53-5. (Condensed from *Plant Breed. Abstr.*, **25**, p. 84.)

Hardy, high-yielding black currant varieties with large good quality fruits were obtained by crossing Siberian forms with European varieties. Nadežda and Desertnaja Altaja are notable for their large fruits, and

Golubka and Stahanovka Altaja for their productiveness. The latter had the highest vitamin C content.

805. Sergeeva, K. D. 1954. (New gooseberry varieties.) *Priroda, Leningrad*, No. 9, pp. 100-2. (Condensed from *Plant Breed. Abstr.*, **25,** p. 84.)
Large-fruited *Sphaerotheca*-resistant varieties have been developed at Mičurinsk. They include Ruskiĭ, Pioner, and Severnyĭ Vinograd, obtained by pollinating Careless with mixed pollen from *Sphaerotheca*-resistant varieties, and the hybrids Malahit from Cernyĭ Negus × Finik, Plodorodnyĭ from Oregon × Finik, and Desertnyĭ from English Yellow × Štambovyĭ.

806. Sergeeva, K. D. 1955. (A spineless gooseberry.) *Priroda, Leningrad*, No. 10, pp. 96-8. (From *Plant Breed. Abstr.*, **26,** pp. 295-6.)
A spineless form that produces large fruits and shows resistance to *Sphaerotheca* has been bred at Mičurinsk. It was obtained as follows. First, *Grossularia robusta* was fertilized by mixed pollen from large-fruited European varieties and a spineless segregate was isolated. This was then pollinated by the mixed pollen of two subspinose American varieties.

807. Sergeeva, K. D. 1955. (New gooseberry varieties into production.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 11, pp. 59-61. (Condensed from *Plant Breed Abstr.*, **26,** p. 296.)
The new *Sphaerotheca*-resistant varieties Smena, Rekord, Mysovskiĭ 37, Russkiĭ, and Malahit have high quality fruit. Plodorodnyĭ, Russkii, Izumzud and Pioner are notable for their high yields.

808. Sharpe, R. H., and **Dickey, R. D. 1954.** Erect and trailing blackberries in Florida. *Circ. Fla agric. Exp. Sta.*, **S-67,** 8 pp.
Blackberry varieties of northern origin require more chilling than usually occurs in Florida winters. This results in prolonged dormancy and poor fruit set.

Advance does well in nearly all parts of Florida. It is a vigorous, heavy yielding, trailing evergreen with small to medium fruit, ripening in late April. It is very resistant to double blossom and is moderately susceptible to leaf spot and anthracnose. Two similar strains are sold together to ensure pollination.

Regal-Ness has large, firm, good quality fruit, ripening in late April. The variety is heavy cropping but susceptible to leaf spots and to anthracnose. Big-Ness is similar to Regal-Ness but the fruit is slightly larger, it is less productive but more resistant to leaf spots. Earli-Ness is a heavy yielder with firm fruit of a lower quality than that of Regal-Ness. Growth, season and susceptibility to leaf spots are about the same as in Regal-Ness. Young and Boysen have large, soft, good quality fruit but too high chilling requirement for peninsular Florida.

Sherwood, H. 1932. *See* **Darrow, G. M.,** and **Sherwood, H.**

809. Shoemaker, J. S. 1931. Three promising new varieties of small fruits. *Bi-m. Bull. Ohio agric. Exp. Sta.*, **149,** pp. 41-6.
Descriptions of the New Logan black raspberry, which is earlier and more resistant to viruses than the Cumberland, and of the Chief red raspberry are included.

810. Shoemaker, J. S. 1955. Small Fruit Culture. McGraw-Hill Book Co. Inc., 447 pp.

811. Sidorenko, M. F. 1955. (Scientific achievements—for the kolhoz and sovhoz orchards.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 11, pp. 47-51. (From *Plant Breed. Abstr.*, **26,** p. 280.)
Gooseberry hybrids 35-52, 39-62, and 16-39, which all have Zaporozje as their female parent, are characterized by high yield, large fruit, and resistance to *Sphaerotheca.*

812. Simmons, W. A. 1950. Secretary's corner. *N.S. Dak. Hort.*, **23,** pp. 141, 144. (From *Plant Breed. Abstr.*, **21,** p. 418.)
A note by A. F. Yeager on an introduction from Korea, believed to be *Rubus morifolius*, is quoted. The species has produced more berries in its third growing season than any cultivated raspberry variety.

813. Simonov, I. N. 1949. (The use of the mixed pollen fertilization method and the choice of pollinators for currants.) *Agrobiology, Moscow*, No. 5, pp. 133-4. (Condensed from *Plant Breed. Abstr.*, **20,** p. 339.)
The mixed pollen of three pollinating varieties of currant gave better fruits and cropping than pollen of a single variety or mixed pollen of two.

814. Simonova, M. N. 1950. (Using the method of I. V. Mičurin.) *Agrobiology, Moscow*, No. 3, pp. 45-51. (Condensed from *Plant Breed. Abstr.*, **21,** pp. 184-6.)
In gooseberry breeding, crossing between mildew-resistant American varieties and large fruited Russian varieties followed by backcrossing in both directions, was the principal method used. The powdery mildew resistant varieties Pjatiletka, Mysovskiĭ 17 and Mysovskiĭ 37 which were derived from Houghton × Limonnyĭ Ispolinskiĭ were standards for Moscow province.

815. Simonova, M. N. 1950. (New gooseberry varieties.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 6, pp. 28-31. (Condensed from *Plant Breed. Abstr.*, **21,** p. 419.)
Rekord 10-46 (from Houghton × Finik) and Jahontovyĭ 4-24 and variety 4-18 (from Houghton × Avenarius) are late varieties, Smena 7-24 and Izumzud 3-86 (both from Houghton × Zelenyĭ Butyločnyĭ) are mid-season, and Jantarnyĭ 1-82 (from Limonnyĭ Ispolinskiĭ × Houghton) is an early variety; Geroĭ 2 (from Houghton × Finik) and Krasnaja Zarja 3 (from Houghton × Varšavskiĭ) are mid-season.

These eight varieties have larger fruits than those of Houghton and all are resistant to *Sphaerotheca.* A high proportion of *Ribes divaricatum* hybrids show immunity but the fruits are small and dark and flavour is poor.

816. Simonova, M. N. 1955. (The production of large-fruited *Sphaerotheca*-resistant varieties of gooseberry. *Agrobiology, Moscow*, No. 4, pp. 272-5. (Condensed from *Plant Breed. Abstr.*, **26,** p. 296.)
Mysovskiĭ 17, Smena, and a number of other *Sphaerotheca*-resistant varieties have been obtained by crossing large fruited European varieties with Houghton and other disease-resistant forms. To improve fruit size the new forms have been crossed again with European varieties.

Singleton, W. R. 1940. *See* **Jones, D. F., and Singleton, W. R.**

817. Slate, G. L. 1933. Raspberry varieties. *Proc. N.Y. St. hort. Soc.*, **78,** pp. 290-5.
Descriptive information and comments on behaviour are given for a number of red raspberries, including June, Ontario, Cuthbert, Viking, Newburgh, Lloyd George, Chief, and Ranere.

818. Slate, G. L., and **Rankin, W. H. 1933.** Raspberry growing in New York State. Cultural practices and disease control. *Bull. N.Y. St. agric. Exp. Sta.*, **625,** 62 pp.
Latham is resistant to both red and yellow mosaic, while Herbert and Newburgh escape infection.

Descriptions of mosaic symptoms in red, purple, and black raspberries are given, and the use of resistant or escaping varieties plus roguing is recommended.

Cane spot, most damaging to blacks and to a lesser extent to purples, is rare on red raspberries. Spur blight may cause considerable loss in red varieties through non-development of fruiting laterals. Powdery mildew occurs occasionally on red raspberries, particularly Latham. *Verticillium* wilt and root gall rarely cause serious damage. Latham, Chief and Herbert are specially hardy against winter injury.

819. Slate, G. L. 1934. The best parents in purple raspberry breeding. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 108-12.
The raspberry breeding records of the Geneva Station, New York, which date from 1893, are summarized. The combinations black × red, purple selfed, purple × purple and (purple × red) selfed were successful but if black varieties were used as pollen parent the result was usually a failure. In black × red crosses, 7·4% of the seedlings merited further testing. Purple × red crosses produce some excellent seedlings but these will neither sucker nor root at the tips. Purple × purple yields a variable population none of which is red or black. Many exhibit various degrees of sterility and considerable variation in vigour is present. However, all but one of the purple × purple crosses involved individuals of the same ancestry.

One of the most promising crosses is that between Dundee and Newburgh, 24% of its seedlings being worthy of further testing, whereas Dundee × Lloyd George yielded only 0·7% of desirable seedlings. In the latter cross 16·5% of the plants were autumn fruiting.

820. Slate, G. L. 1935. Home garden raspberries. *Horticulture, Boston,* **13,** p. 123. (From *Plant Breed. Abstr.*, **5,** p. 363.)
The mosaic resistance of certain varieties of recent origin is mentioned including Newburgh, Chief, Potomac, and Sodus. Sodus, a purple-fruited type from a cross between Dundee and Newburgh, is regarded as specially promising.

821. Slate, G. L. 1935. The best parents in red raspberry breeding. *Proc. Amer. Soc. hort. Sci.*, **32,** pp. 407-10.
Lloyd George has proved one of the most valuable parents, particularly in combination with Newman or with Newburgh. Newman has proved nearly as good as Lloyd George in yielding valuable seedlings, its best crosses being those with Herbert, Lloyd George and Cuthbert. Loudon has shown value; Latham arose from Superlative × Loudon and Latham selfed gave rise to Chief. June and Marlboro have given fair results

especially in introducing earliness. Herbert must be crossed with firm fruited varieties to produce firm offspring. Cuthbert may be of value in breeding for canning and freezing. Viking has not proved outstanding. The following have proved unsatisfactory parents: Erskine Park, Buckeye, Count, Donboro, Empire, Owasco, Syracuse, Gold Drop, Ohta, Ranere, Superlative, Newman No. 20 and Marldon.

822. Slate, G. L. 1936. Name new red raspberry after O. M. Taylor . . . *Fm Res. N.Y.*, **2** (2), pp. 1, 11-12. (From *Plant Breed. Abstr.*, **7,** p. 95.)
Produced by a cross between Newman and Lloyd George, Taylor is noteworthy for its large, bright, attractive, firm, cohesive fruits. The plants are tall and vigorous, produce heavy crops and multiply rapidly. The canes are sturdy and support will not be necessary. The prickles are short and should not interfere with picking. Other promising seedlings were derived from the same cross.

823. Slate, G. L. 1936. New varieties of small fruits. *Horticulture, Boston,* **14,** p. 129.

824. Slate, G. L. 1936. Three new raspberries share the limelight. *Fm Res. N.Y.*, **3** (1), pp. 11, 13.
Descriptions are given of three new raspberries developed at Geneva, namely Marcy, Indian Summer, and Sodus.

825. Slate, G. L. 1936. Two excellent new red raspberries. *Horticulture, Boston,* **14,** p. 364.
Deals with Marcy, the largest red raspberry available for planting, and Indian Summer.

826. Slate, G. L. 1937. Newer varieties of small fruits and grapes. *Proc. 17th annu. Mtg Ohio hort. Soc.*, pp. 89-99.

827. Slate, G. L. 1938. New or noteworthy fruits. XII. Small fruits. *Bull. N.Y. St. agric. Exp. Sta.*, **680,** 18 pp.
Fourteen new varieties of small fruits are described and evaluated. These include Indian Summer, Marcy, Monroe, and Taylor red raspberries; Bristol, Dundee, and Evans black raspberries; Marion and Sodus purple raspberries; and Red Lake currant. A series of promising raspberry seedlings has been developed from crosses between Lloyd George and other varieties. One of these, Indian Summer, is an autumn fruiting type which may escape mosaic. Its berries, however, are soft and somewhat crumbly. The Sodus purple raspberry (Dundee × Newburgh) may partly replace Columbian, which is completely infected with mosaic. Marion (a late purple of Bristol × Seedling 2585 parentage) and Sodus are both drought resistant.

828. Slate, G. L. 1940. Breeding autumn fruiting raspberries. *Proc. Amer. Soc. hort. Sci.*, **37,** pp. 574-8.
Environment has a direct effect on the expression of the autumn-fruiting character. Ranere, though autumn fruiting, is not a promising parent for New York conditions except to introduce earliness of the autumn crop into Lloyd George crosses.

The polyploid group includes the triploids, All Summer, Belle de

Fontenay, Erskine Park, Merveille Rouge, November Abundance and White Queen, and the tetraploids Everbearing, Hailsham, La France, Merveille Rouge, Merveille de Quatre Saisons and Surpasse Merveille Blanc. Probably Buckeye, Colossus and Souvenir de Desiré Bruneau are polyploids also. The value of the polyploid group in breeding autumn fruiting varieties is doubtful because of the low proportion of viable pollen they produce. Lloyd George and its offspring are the best source yet discovered of the autumn-fruiting character in raspberries, but a decided advance of the ripening date is needed to ensure an autumn crop in an early cold fall. This character will probably have to be obtained from Ranere.

829. Slate, G. L. 1941. Raspberries. *Proc. 86th annu. Mtg N.Y. St. hort. Soc.*, pp. 274-8. (Condensed from *Plant Breed. Abstr.*, **11**, pp. 320-1.)
Seedling NY13618, from Lloyd George × Newburgh, is a late ripener. Grown for seven years among mosaic infected material, it has not had a single plant infected.

830. Slate, G. L. 1942. 'Milton'—a new red raspberry. *Fm Res. N.Y.*, **8** (4), pp. 7, 9.
Milton, from Lloyd George × Newburgh, is a late variety.

831. Slate, G. L. 1944. Methods and problems in raspberry breeding. *Proc. Amer. Soc. hort. Sci.*, **45**, pp. 255-8.
A summary of the methods, problems, and objectives of the raspberry breeding project at Geneva. Outstanding seedlings are usually found only in populations containing a high proportion of meritorious individuals. Populations of 50-100 are probably sufficient to indicate the possibilities of a combination, and populations of 500-1,000 will usually realize the profitable potentialities of a combination.

In breeding autumn fruiting raspberries, using derivatives of Lloyd George, F_2s have been raised from sib-crosses, backcrosses, and selfs. All these types of mating showed marked reduction in vigour and heavy mortality in the resulting seedlings. For hybrid vigour it is proposed to utilize autumn fruiting selections of *R. strigosus* combined with various American varieties; these could be crossed with Lloyd George derivatives which would contribute large size, klendusity to mosaic, and autumn fruiting.

With black raspberries there is little if any inbreeding depression.

F_2s of purple hybrids vary considerably in vigour but are usually less vigorous than their parents. No typical red or black raspberries were recovered in F_2. Lloyd George, though excellent as a parent in red raspberry breeding, is poor in crosses with blacks.

Klendusity is being used in breeding red raspberries less subject to mosaic but the phenomenon is not yet known in blacks.

832. Slate, G. L. 1944. Newer small fruits. *Amer. Fruit Gr*, **64** (6), pp. 8, 21.

833. Slate, G. L., and Suit, R. F. 1944. A second report on the breeding of autumn-fruiting red raspberries. *Proc. Amer. Soc. hort. Sci.*, **44**, pp. 283-8.
Crosses between Ranere and other autumn-fruiting types gave 32·7% of autumn-fruiting progeny. Half-sib crosses and sib crosses between autumn-

fruiting types gave 32·9% and 28·1% respectively. Crosses of Indian Summer × Marcy and Milton, backcrossed to Indian Summer gave 47·1%, but the populations were small. F_2s of Taylor × Indian Summer, Marcy × Indian Summer, Milton × Indian Summer and of (Newburgh × Lloyd George) × Indian Summer averaged 36·8% of autumn fruiters.

The F_1s of Marcy × Indian Summer, Taylor × Indian Summer, Milton × Indian Summer, and 14477 × Indian Summer gave a total of 555 seedlings of which 31·1% were autumn fruiting. The backcross of Lloyd George × Indian Summer gave 60·8% autumn fruiters out of a population of 35.

In the F_2 of Marcy × Indian Summer 57% had many ripe berries and 29% had some ripe fruit on 8 October. Except for this one progeny, the percentages of plants having several canes with ripe berries on 8 October ranged from 0 to 25, the lower figure being by far the more common.

Several of the progenies suffered severely from powdery mildew (*Sphaerotheca humuli*), others appeared to carry some resistance.

Female sterility occurred in some of the seedlings derived from Ranere.

834. Slate, G. L. 1948. Breeding autumn-fruiting raspberries: Third report. *Proc. Amer. Soc. hort. Sci.*, **51**, pp. 301-3.

The small numbers of early autumn-fruiting seedlings which appear necessitate the growing of very large populations of a number of different combinations. It will be difficult to produce large numbers of early ripening seedlings possessing the essential characteristics of large size, bright red colour, firmness, freedom from crumbling, and high dessert quality, combined with vigour, productiveness, hardiness, and virus resistance. These characters are available chiefly in varieties from which good results in breeding early autumn-fruiting raspberries have not yet been obtained.

Slate, G. L. 1950. *See* **Heit, C. E.,** and **Slate, G. L.**

835. Slate, G. L. 1951. New small fruits developed at Geneva. *Fm Res. N.Y.*, **17** (4), p. 7.

Describes the raspberries September and Amber, and the blackberries Hedrick (Eldorado × Brewer) and Bailey.

836. Slate, G. L. and **Klein, L. G. 1951.** Some results from the breeding of red raspberries. *Proc. Amer. Soc. hort. Sci.*, **57**, pp. 155-7.

A report on the results from red raspberry crosses made in 1945. Twenty-four crosses involving 10 varieties and 7 selections were used to produce 11,028 seedlings from which 164 selections were made. Crosses involving St. Walfried were outstanding in producing good seedlings. Another outstanding cross was N.Y.16868 × N.Y.16135. Many combinations failed to yield seedlings of value; thus Herbert × Newman and its reciprocal gave a total of 1,316 seedlings of which none were selected. Yet this cross produced Newburgh in 1921.

837. Slate, G. L., and **Klein, L. G. 1951.** Blackberry breeding. *Proc. Amer. Soc. hort. Sci.*, **57**, pp. 158-62.

In crosses made in 1929-1943, 22 varieties and selections were used as parents in 40 different combinations to produce 3,588 seedlings from which 126 selections were made. Crosses between Eldorado and Brewer were good, and Russell × Erie proved valuable for producing late seedlings. Populations with Bailey as one parent averaged very well.

838. Slate, G. L., and **Klein, L. G. 1952.** Black raspberry breeding. *Proc. Amer. Soc. hort. Sci.*, **59**, pp. 266-8.

Bristol and Evans produced at Geneva, N.Y., in 1921 both derive from Watson Prolific × Honeysweet.

Bristol and Dundee have proved to be good parents, whereas Shuttleworth, Kansas, Quillen, Logan, Cumberland, Morrison, and Naples are of little value as parents. Backcrossing black × purple selections to the black raspberry failed to increase fruit size in the black raspberry as did one sib-cross between two (black × purple) selections. One major failing of nearly all the seedlings was too much pubescence on the fruit; the cross Rachel × Dundee was the best in this respect.

839. Slate, G. L., Braun, A. J., and **Mundinger, F. G. 1953.** Raspberry growing: culture, diseases, and insects. *Ext. Bull. Cornell agric. Exp. Sta.*, **719**, 68 pp.

This bulletin includes a section on varieties in which the following are described and discussed (they are arranged in order of ripening):

Red raspberries.—June, very susceptible to mosaic; thornless. *Ontario*, similar to June. *Indian Summer*, considered inferior to September. *September*, the fall crop of this begins to ripen about September 1; its plugging is not always easy. *Newburgh*, rarely infected with mosaic but when it is the symptoms are distinct; a mid-season variety; plugging is not quite easy. *Taylor*, nearly as hardy as Latham, is a sturdy upright plant which does not require support. *Latham* is the most widely grown variety of red raspberry in the country as a whole but it frequently harbours mosaic and the disease spreads rapidly from it. *Milton* has remained free from mosaic for 10 years in tests where susceptible varieties usually become infected in two years.

Black raspberries.—Shuttleworth is probably about the best extra early variety and it is moderately tolerant of green mosaic. *Evans* does not endure mosaic well. *Logan* is not as good as other varieties of its season; its chief merit is immunity to leaf curl. *Bristol* endures mosaic fairly well and is tall, vigorous, hardy, and very productive. *Dundee* is a high quality, large-fruited variety ripening midway between Bristol and Naples. It acquires green mosaic readily. *Cumberland* is very subject to anthracnose and all of the virus diseases. *Morrison*, a new variety of Ohio origin, is a promising late type.

Purple raspberries.—Sodus is more vigorous, hardier, more drought resistant and more productive than Columbian. Its relative freedom from mosaic also makes it preferable to Columbian. *Columbian* is the standard and most widely known purple raspberry, being popular for jam and canning. All stock is infected with green mosaic, symptoms being mild. *Webster* is becoming popular because of its firmness and productivity, and because the berries are well displayed. *Marion* is susceptible to orange rust. It is unusually large and productive.

Diseases and their control

Mosaic: Plum Farmer is very susceptible, and black raspberries as a group suffer severely. The more susceptible red varieties such as Ontario, June, Viking, Marlboro, Perfection, and Cayuga do not pay when mosaic is extensive. Newburgh and Chief usually escape infection. Milton, Marcy, Indian Summer and September avoid infection.

Anthracnose (*Plectodiscella veneta*): Plum Farmer and Cumberland are readily infected, Quillen is almost immune, and Naples is commercially

resistant. Among reds Latham, June, and Ontario are commonly attacked while Newburgh, Taylor, and Marcy are less seriously affected.

Spur blight (*Didymella applanata*): Indian Summer, Taylor, Newburgh, and Latham become diseased readily, while Marcy, Chief, Cuthbert, Viking, and Ontario do not contract the disease so easily.

Mildew (*Sphaerotheca humuli*) is usually of importance only on Latham, though it is sometimes prevalent on black raspberries, especially on Dundee.

Wilt (*Verticillium albo-atrum*): No species or variety of raspberry is known to escape possible wilt attacks. Losses are heaviest in blackcaps.

Orange rust (*Gymnoconia interstitialis*) sometimes affects blackcaps but never reds or purples.

Autumn rust (*Pucciniastrum americanum*): Latham is particularly susceptible but the disease also attacks Ontario, Viking and other varieties.

Winter injury: Viking, Adams 87, Latham, and Chief are rated as hardy; June, Ontario and Newburgh are less cold resistant; Cuthbert, Cayuga, and Lloyd George are relatively tender.

840. Slate, G. L. 1954. New raspberry varieties. *Bull. N.Y. St. agric. Exp. Sta.*, **763,** 4 pp.

Descriptions are given, with coloured illustrations of September, Milton and Amber, the first two being red raspberries and the last apricot coloured. September, from Marcy × Ranere, is autumn fruiting, the autumn crop being 3-4 weeks earlier than that of Indian Summer; its summer crop is a week earlier than Newburgh.

Milton (N.Y.13618), from Lloyd George × Newburgh, escapes mosaic and is resistant to frost. A late type, it ripens 2-3 days later than Taylor and Latham.

Amber, from Taylor × Cuthbert, is a late variety.

841. Slate, G. L. 1954. New blackberry varieties. *Bull. N.Y. St. agric. Exp Sta.*, **764,** 4 pp.

Descriptions and coloured illustrations are given of Bailey and Hedrick. The origin of Bailey is unknown. Hedrick, from Eldorado × Brewer, is susceptible to orange rust.

Slate, G. L. 1954. *See* **Lee, F. A.,** and **Slate, G. L.**

842. Slate, G. L., and **Klein, L. G. 1954.** A second report on the breeding of purple raspberries. *Proc. Amer. Soc. hort. Sci.*, **63,** pp. 262-4.

Results from crossing black with red raspberries to produce purple raspberries are presented. Of the 11 combinations tried, only the crosses Bristol × N.Y.17861 (Newburgh × Indian Summer) and Cumberland × Newburgh produced desirable seedlings.

Smith, B. W. 1949. *See* **Williams, C. F., Smith, B. W.,** and **Darrow, G. M.**

843. Snell, W. H. 1941. Two pine plantings near cultivated red currants in New York. *J. For.*, **39,** pp. 537-41. (Condensed from *Exp. Sta. Rec.*, **85,** p. 637.)

The author considers that red currants are of no importance in disseminating blister rust to white pines. Data from two pine plantings confirm this conclusion, in that little if any pine infection was traceable to red currants; probably all of it originated from sporidia on wild gooseberries.

844. Snell, W. H. 1941. Blister rust studies of three patches of red currants in New York. *Phytopathology*, **31,** pp. 732-40.

845. Snell, W. H. 1941. The relation of cultivated red currants to the white pine blister rust in New York State. *J. For.*, **39,** pp. 859-67. (Condensed from *Exp. Sta. Rec.*, **86,** p. 350.)

This paper shows that the literature generally agrees on the low degree of susceptibility of red currants and that it contains few references to white pine infection originating from them. Observations indicate that, in general, white pines even when close to red currants are not infected with blister rust, unless wild *Ribes* are at least as near to the pines as the red currants.

846. Snell, W. H. 1942. The production of sporidia of *Cronartium ribicola* on cultivated red currants in relation to infection of white pine. *Amer. J. Bot.*, **29,** pp. 506-13.

Red currants produced only a fraction of the number of telia and sporidia produced by black currants.

847. Snyder, J. C. 1936. Flower bud formation in the Latham raspberry. *Proc. Amer. Soc. hort. Sci.*, **33,** pp. 417-22.

Spangelo, L. P. 1951. *See* **Ferguson, W., Spangelo, L. P.,** and **Cameron, D. F.**

848. Spangelo, L. P. S. 1955. Raspberries. *Progr. Rep. Cent. exp. Fm, Ottawa, 1949-53*, pp. 26-8.

In a search for resistance to anthracnose, *Elsinoë veneta*, 5,258 seedlings from crosses between the varieties Gatineau, Madawaska, Muskoka, Ottawa, Rideau, Trent, and Tweed were sprayed with a water suspension of the conidia, a temperature of 60-65° F. being maintained for 48 hours. All seedlings appeared equally and fully susceptible. Artificial inoculation in the field failed.

Many seedlings from crosses involving Gatineau, Madawaska, Muskoka, Ottawa, Rideau, Trent, and Tweed lacked vigour.

Ottawa is highly susceptible to *Sphaerotheca humuli* (DC.) Burr. and Muskoka and Trent are moderately susceptible. Crosses of Ottawa with Muskoka, Tweed and Rideau gave numerous susceptible seedlings. Madawaska × Milton gave 68·8% of seedlings with no infection.

A large number of seedlings, mostly from crosses between the Ottawa varieties, showed no differences in progeny susceptibility to *Didymella applanata* (Niessl.) Sacc. Susceptibility appeared to be correlated with number of canes and amount of foliage.

A description of named or introduced seedlings (by A. W. S. Hunter and L. P. S. Spangelo) is included:

Muskoka 0-201 (Newman 23 × Herbert).—Outstanding in hardiness.

Tweed 0-263 (Newman 23 × Lloyd George).—Outstanding in earliness, production and hardiness.

Thames 0-277 (Lloyd George × Newman 23).—Very late maturing, somewhat lacking in hardiness.

0-381 (Lloyd George × Newman 23) × Viking.—A large, medium dark, medium firm, good quality berry.

0-382 (Ottawa × Rideau).—A large, medium dark, medium firm, good quality berry.

0-383 (Ottawa × Madawaska).—Resembles Madawaska and is large, medium dark, and medium in firmness and quality.

0-384 ((Royal Purple × Newman 23) × Viking) × Trent.—A large berry, slightly rough and coarse, medium dark, and of medium quality.

849. Spaulding, P., and Gravatt, G. F. 1917. Inoculations on *Ribes* with *Cronartium ribicola*. *Science*, **46,** pp. 43-4. (Condensed from *Exp. Sta. Rec.*, **38,** p. 151.)

The authors inoculated 82 varieties of cultivated red, black, and white currants, 23 varieties of cultivated gooseberries, and 42 species and hybrids of *Ribes* from various parts of the world.

The varieties of cultivated species of *Ribes* were found to show considerable variation in their susceptibility to *C. ribicola*.

In addition to the above species and hybrids, successful inoculations are reported on numerous unidentified species of *Ribes*, including over 100 collections made in the North-west and Pacific Coast States. Thus far no species has proved entirely resistant to the rust.

850. Špiler, E. E. 1948. (Winter hardiness and drought resistance of raspberry and dewberry varieties under the conditions of the southern Ukrainian S.S.R.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 9, pp. 36-8. (From *Plant Breed. Abstr.*, **19,** p. 393.)

Variety tests, with 70 raspberry and 4 dewberry varieties at the Melitopol Scientific Research Station of Fruit Growing, in the Ukraine, have led to the following conclusions. The raspberry varieties Rubi, Produktivnaja, Maljboro 109 (Marlboro 109), Maljboro 112, Krimson Mamut, Turner, and King were the hardiest and most resistant to drought. All autumn fruiting varieties of raspberry and dewberry, excepting Remontannaja Billiardi and Vse Leto, were highly susceptible to cold injury. In breeding new varieties that are resistant to drought, best results are expected from hybridization of the better raspberry varieties with dewberries, which have deeper roots.

851. Špiler, E. E. 1948. (The breeding of *Sphaerotheca* resistant gooseberry varieties.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 6, pp. 28-31. (Condensed from *Plant Breed. Abstr.*, **19,** p. 394.)

The following varieties were immune: Mysovskiĭ 17, Mysovskiĭ 37, Vinogradnyĭ, and Negus. These varieties were also the most resistant to drought. Of the varieties grown locally, Krasnyĭ Žaket derived from Houghton × Red Warrington, was consistently resistant to *Sphaerotheca* and the resistance was recessive in a range of crosses of this type with other varieties.

Spinks, G. T. 1919. *See* **Barker, B. T. P., and Spinks, G. T.**

852. Spinks, G. T. 1928. Progress report on fruit breeding. *Rep. Long Ashton Res. Sta.*, pp. 17-22.

Under raspberries it is noted that out of 150 seedlings from Norwich Wonder × Baumforth A, 22 were *obtusifolius* type males.

853. Spinks, G. T. 1932. Progress report on fruit breeding. *Rep. Long Ashton Res. Sta.*, pp. 19-23.

Black currants: The following new varieties have been distributed:

Mendip Cross. Same season as Boskoop but a heavier cropper; fruit

large and bright, on moderately long trusses; fairly resistant to leaf spot. Parentage, Baldwin × Boskoop, 1921.

Cotswold Cross. Same season as Baldwin but a heavier cropper. Fruit moderately large, on compact trusses. Parentage, Baldwin × Victoria, 1920.

Blackberries:

Ashton Cross. Similar to wild blackberry; good flavour, good canner, heavy cropper; ripe from mid-August onwards. Parentage, blackberry open pollinated, 1920.

854. Spinks, G. T. 1934. Progress report on fruit breeding. *Rep. Long Ashton Res. Sta.*, pp. 24-8.

Ashton Cross and other seedling blackberries from the same family are all susceptible to rust (*Kuehneola albida*). The fungus was not found on Himalaya and Black Diamond.

855. Spinks, G. T., and **Clothier, G. E. 1935.** The incidence of 'reversion' in seedling black currants and in clones derived from them. *Rep. Long Ashton Res. Sta.*, pp. 58-66.

Reversion was more common in families of Baldwin × French and the reciprocal than in families of Baldwin × Victoria, Baldwin × Boskoop, and Boskoop × Baldwin. No correlation was found between the occurrence of reversion and big bud.

856. Spinks, G. T. 1946. Progress report on fruit breeding. *Rep. Long Ashton Res. Sta.*, pp. 20-3.

Black currants. Malvern Cross, named and distributed in 1946, is slightly later than Baldwin and its berries are easily detached from the strig and have thick skins.

857. Spinks, G. T. 1947. Black currant breeding at Long Ashton. *Rep. Long Ashton Res. Sta.*, pp. 35-43.

In the period 1913-1947, of 2,139 self-bred seedlings from various sources only 4 plants were still under trial in 1947, whereas out of 1,585 crossbred seedlings 5 were still on trial at the same date, and, in addition, 3 seedlings had been named and released.

Mendip Cross, from Baldwin × Boskoop, and Cotswold Cross, from Baldwin × Victoria, were released in 1933. Malvern Cross, also from Baldwin × Victoria, was released in 1946. These three named varieties are all less susceptible than Baldwin to leaf-spot fungus and they are not sulphur susceptible.

In breeding for a combination of lateness of ripening with high ascorbic acid content, Baldwin was chosen as one parent because it is fairly late and has the highest ascorbic acid content of any variety in cultivation. Malvern Cross, which is later in season and has a low ascorbic content, was also used. The vigour of seedlings was classified into (a) vigorous, (b) moderately vigorous, (c) medium, (d) moderately weak, and (e) weak. (Table I.)

Data are also given for habit of bush, season of bloom, length of truss, crop, size and season of fruit. There appears to be no relationship between season of flowering and season of fruit. No self-bred family yielded any plants classed as heavy cropping, whereas all the crossbred families contained plants in this class. Size of fruit appeared to be distributed on a normal curve basis except that in self-bred families the larger sizes were often deficient.

TABLE 1

	Vigour					Fruit size					Season of bloom				
	a	b	c	d	e	Large	Mod. large	Med.	Mod. small	Small	Early	Mod. early	Med.	Mod. late	Late
Baldwin selfed	—	—	3	3	16	—	—	12	6	4	14	3	3	2	—
Boskoop selfed	—	—	2	9	19	1	3	15	4	4	1	1	16	14	6
French selfed	1	1	21	28	62	1	2	50	22	13	1	1	28	54	34
Baldwin × French	3	14	103	14	38	1	17	109	38	3	46	30	52	20	30
French × Baldwin	6	15	97	21	51	2	14	104	46	14	46	30	62	20	29
Baldwin × Seabrook	—	1	25	9	4	—	—	26	12	1	15	—	11	2	10
Baldwin × Boskoop	1	—	54	52	101	6	40	110	47	8	87	51	44	16	7
Boskoop × Baldwin	39	14	84	13	11	10	45	75	29	2	56	26	48	19	12
Baldwin × Victoria	129	31	66	3	2	16	39	160	17	1	89	9	47	8	53
Boskoop × Seabrook	5	1	58	8	7	6	19	42	2	—	2	—	31	24	26

Table II

	Length of truss					Season of fruit				
	Long	Mod. long	Med.	Mod. short	Short	Early	Mod. early	Med.	Mod. late	Late
Baldwin selfed ..	—	1	15	4	2	—	—	13	4	5
Boskoop selfed ..	1	2	21	2	2	12	4	10	2	1
French selfed ..	—	3	44	11	30	2	17	64	6	3
Baldwin × French ..	2	6	67	38	55	6	9	74	46	38
French × Baldwin ..	6	7	74	33	59	2	10	46	47	71
Baldwin × Seabrook	4	6	22	5	2	2	4	22	6	4
Baldwin × Boskoop	3	43	123	29	6	14	44	121	23	10
Boskoop × Baldwin	15	44	90	4	5	6	33	78	30	18
Baldwin × Victoria ..	9	33	146	40	9	11	11	67	50	92
Boskoop × Seabrook	6	13	40	6	6	10	—	37	19	8

The family of French selfed contained abnormal leafed plants confirming Tydeman's (1930) findings.

Tydeman's (1938) conclusion is largely confirmed that hybridization between varieties now in cultivation may result in hitherto unknown combinations of good characters in one plant but that, except in season of ripening, improvement is unlikely in any one character over the existing level present amongst commercial varieties.

858. Spirina, V. V. 1949. (Gooseberries in the eastern zone of the Vologda Province.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 12, pp. 22-4. (Condensed from *Plant Breed. Abstr.*, **21**, p. 184.)

Podobnyi Šanonu is hardy and resistant to *Sphaerotheca*, its fruits are hairy, asymmetrical, thick skinned, pale green tinged with yellow. Sejanec Flamingo is hardy and immune to *Sphaerotheca*; its fruits are a dull crimson, sometimes some hairs are present; the skin is thick. Seedling 108 lacks hardiness but is immune to *Sphaerotheca*, as are seedlings 105 and 176 and the variety Pušistyĭ.

859. Stace-Smith, R. 1954. Chlorotic spotting of black raspberry induced by the feeding of *Amphorophora rubitoxica* Knowlton. *Canad. Ent.*, **86**, p. 232-5.

The aphid *Amphorophora rubitoxica* n.sp. (Knowlton) was found to cause chlorotic spotting of leaves of black raspberry. No marked spotting was caused when the aphid fed on *Rubus idaeus* L., Pacific blackberry (*R. vitifolius* Cham. and Schlecht.) and Himalaya blackberry (*R. procerus* P. J. Muell.). The symptoms were not due to virus infection.

Both *A. rubi* and *A. rubitoxica* are commonly found on cultivated and wild black raspberries in British Columbia, while *A. rubi* only is found on wild red raspberry, and *A. rubitoxica* only on wild Pacific blackberry.

A. rubitoxica does not transmit leaf mottle and yellow mosaic viruses, although *A. rubi* is a vector of both.

860. Stace-Smith, R. 1955. Studies on *Rubus* virus diseases in British Columbia. I. *Rubus* yellow-net. *Canad. J. Bot.*, **33**, pp. 269-74.

A virus disease occurring on Himalaya blackberry (*Rubus procerus* P. J. Muell.) was transmitted to Washington red raspberry (*R. strigosus*

Michx.), tropical black raspberry (*R. albescens* Roxb.) and N. American black raspberry (*R. occidentalis* L.) by grafting or by aphid transmission. A net-like chlorosis of the tissue bordering the smaller leaf veins is the characteristic symptom, consequently the name '*Rubus* yellow-net' is proposed for the virus and disease. The virus is transmitted by the raspberry aphid *Amphorophora rubi* Kalt. It may be acquired by the aphid after 1 hr of feeding and usually persists in the vector less than 4 hrs. Yellow-net has not yet been observed in any commercial plantings in British Columbia.

861. Stace-Smith, R. 1955. Studies on *Rubus* virus diseases in British Columbia. II. Black raspberry necrosis. *Canad. J. Bot.*, **33,** pp. 314-22.

In British Columbia several red raspberry varieties carry a latent virus that induces mild symptoms in other red varieties and severe symptoms on black raspberries (*Rubus occidentalis* L.). The name 'black raspberry necrosis' is proposed for the disease and virus. The virus is transmitted by the aphid *Amphorophora rubi* Kalt. It may be acquired by the aphid after ½ hr of feeding and transmitted with a 2-min. transfer feeding. Most aphids lose their ability to transmit the virus within 1½ hrs after leaving the source of inoculum.

862. Stacey, E. C. 1947. Horticulture: Small fruits. *Progr. Rep. Domin. exp. Sta. Beaverlodge 1937-1947*, pp. 72-4.

Recent tests have shown the raspberry varieties, Madawaska, Rideau and Trent to be superior to Herbert in flavour and they appear to be almost completely resistant to mosaic. In winter hardiness they are at least equal to Herbert. Chief is more hardy and drought tolerant than Herbert but is inclined to show greyish fruit when preserved.

Stadtherr, R. J. 1952. *See* **Brierley, W. G., Landon, R. H.,** and **Stadtherr, R. J.**

863. Stahl, J. L. 1946. Chimaeras of Bowen blackberry. An unstable patented plant. *J. Hered.*, **37,** pp. 51-3.

Two plants of the Bowen thornless blackberry, which is similar to or identical with Cory Thornless, produced thorny or partially thorny shoots from thornless canes.

864. Stakman, E. C. 1925. Raspberry mosaic. *Minn. Hort.*, **53,** pp. 85-7.

Latham is stated to be very generally infected, while Herbert, Sunbeam, and St. Regis appear to be resistant.

865. Staryh, N. A. 1948. (Useful gooseberry varieties for Ivanovskaja province.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 10, pp. 28-31. (Condensed from *Plant Breed. Abstr.*, **19,** p. 881.)

The *Sphaerotheca* resistant gooseberry varieties Mysovskiĭ 17 and 37 and Pjatiletka did well in variety trials carried out at Ivanovskaja Province Agricultural Station in the U.S.S.R. The Mysovskiĭ varieties in particular grew vigorously and were moderate in their climatic and soil requirements. They outyielded all other varieties including Houghton, though their fruits were smaller than those of Finik. Mysovskiĭ 17 fruits were equal in flavour to Vinogradnyĭ, an established local variety. Mysovskiĭ 20, another new variety tested, was less promising on account of susceptibility to *Sphaerotheca*.

Stene, A. E. 1936. *See* **Odland, T. E., and Stene, A. E.**

866. Stene, A. E., and Odland, T. E. 1938. Inheritance of thorns in blackberries. *Proc. Amer. Soc. hort. Sci.*, **35,** pp. 54-6.
So-called thornless varieties are usually only partially free from thorns. Austin Thornless (Mayes Thornless) and Santa Rosa (Burbank Thornless) are, however, truly thornless. The thornlessness of Austin Thornless is due to a single dominant gene carried in the heterozygous phase and associated with a factor for partial sterility which detracts from its value in breeding. Crosses involving Cory Thornless, Thornless Youngberry and *Rubus canadensis* have given plants as thorny or more so than the so-called thornless parent.

867. Steup, E. 1927. (The cane disease of the raspberry in Denmark and its control.) *Obst- u. Gemüseb.*, **73** (24), pp. 377-8. (Condensed from *Rev. appl. Mycol.*, **7,** p. 384.)
This is a translation of a paper by Miss A. Weber in the Danish periodical 'Haven', Part 9, 1927. *Didymella applanata* is widespread in Denmark. Superlative, Marlboro and Goliath are particularly susceptible, while Fajstrup and Empress Dagmar are resistant.

868. Stevenson, F. J., and Jones, H. A. 1953. Some sources of resistance in crop plants. *Yearb. U.S. Dep. Agric.*, pp. 192-216.
Sources of resistance in *Rubus* are:
Blackberry
Double blossom (*Cercosporella rubi*): Himalaya, Rogers, Brainerd.
Leaf spot (*Mycosphaerella rubi*): Evergreen, Himalaya; inheritance is multifactorial with resistance partially dominant.
Orange rust (*Gymnoconia interstitialis*): Evergreen, Eldorado, Snyder, Lucretia, Young, Boysen.
Verticillium wilt (*V. albo-atrum*): Evergreen, Himalaya, clones of *R. ursinus*, Logan, Mammoth, Cory Thornless, Burbank Thornless.
Raspberry
Anthracnose (*Elsinoë veneta*): *Rubus coreanus*, *R. biflorus*, *R. kuntzeanus*, *R. morifolius*, *R. parvifolius*, *R. innominatus*, *R. lambertianus*, *R. tephroides*. Inheritance: multiple factor.
Leaf spot (*Septoria rubi*): *Rubus coreanus*, *R. biflorus*, *R. parvifolius*, *R. morifolius*, *R. wrightii*, *R. albescens*, *R. innominatus*, Dixie, Van Fleet. Inheritance: multiple factor.
Resistance to aphid vector of raspberry mosaic in U.S.: Lloyd George, Herbert, Newburgh, Newman, Washington, Milton, September, and several other commercial varieties. Inheritance: multiple factor with klendusity partially dominant.

869. Stillinger, C. R. 1944. Notes on *Cronartium occidentale*. *Northw. Sci.*, **18,** pp. 11-16.
Natural infection by *C. occidentale* was found on *Ribes aureum*, *R. lasianthum*, *R. hesperium*, *R. parishi*, *R. roezlii*, *R. speciosum*, *R. cereum*, *R. indecorum*, *R. inerme*, *R. malvaceum*, *R. nevadense*, *R. odoratum*, and *R. montigenum*.

870. Stoutemyer, V. T., Maney, T. J., and Pickett, B. S. 1934. A rapid method of propagating raspberries and blackberries by leaf-bud cuttings. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 278-82.

Details are given of a successful method of raising leaf-bud cuttings of black raspberry. The same methods when tried with Chief and Latham failed. Successful cuttings were made of blackberry but rooting was neither as rapid nor as free as with the raspberry.

Strong, W. J. 1927. *See* **Palmer, E. F.,** and **Strong, W. J.**

Sturdy, M. 1950. *See* **Crang, A., Kendall, L.,** and **Sturdy, M.**

Sturdy, M. 1951-55. *See* **Crang, A.,** and **Sturdy, M.**

871. Sudds, R. H. 1934. The comparative gross morphology of the raspberry. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 261-2.
A discussion of the below-ground gross morphology of red and black raspberries.

872. Sudds, R. H. 1935. A study of the morphological changes and the origin of roots in tip-layered Cumberland raspberry plants. *Proc. Amer. Soc. hort. Sci.*, **32,** pp. 401-6.

873. Sudré, H. 1908-1913. *Rubi Europae vel monographia iconibus illustrata Ruborum. Fasc. 1-6, Paris.* (Reported by Gustafsson, Å., 1942.)
Lists 109 main or circle species of *Moriferi veri*, around which are placed 691 more or less distinct species containing in all 1927 varieties given Latin names. Some 3,350 different names applied to species, varieties or supposed hybrids are enumerated.

874. Sudré, H. 1910. (The *Rubi* of Belgium.) *Bull. Soc. bot. belge*, **47,** pp. 185-250.

875. Suit, R. F. 1941. New raspberry varieties and the disease situation. *Fm Res. N.Y.*, **7** (4), p. 2.

Suit, R. F. 1944. *See* **Slate, G. L.,** and **Suit, R. F.**

876. Suit, R. F. 1945. Control of spur blight of red raspberries. *Bull. N.Y. St. agric. Exp. Sta.*, **710,** 14 pp. (Condensed from *Rev. appl. Mycol.*, **25,** p. 125.)
Three years' data showed Indian Summer and Taylor to be very susceptible to *Didymella applanata*; Newburgh, Latham, and Milton were moderately susceptible; Ontario, Viking, Cuthbert, Marcy, and Chief proved slightly susceptible.

877. Šurakov, F. 1946. Berries on the Kola Peninsula. *Agric. Chron. Moscow*, No. 11, pp. 5-6. (Mimeographed.) (Condensed from *Plant Breed. Abstr.*, **17,** p. 476.)
During the last 20 years over 500 varieties of strawberries, raspberries, and red and black currants have been tested at the Polar Experimental Station. The Turner, Mammoth, Marlboro, New Kuzmina, and Spirin Seedling No. 4 raspberry varieties are being increased and a promising variety has been derived from a local wild raspberry known as Hibinka. The Dutch red currant, the local wild red currant Varzuga, and the Marmit black currant have been found to grow well in this region.

878. Swarbrick, T. 1930. A preliminary report of the raspberry variety trials at Long Ashton. *Rep. Long Ashton Res. Sta.*, pp. 27-45.
Anthracnose, mosaic, and mildew were severe on some varieties but Baumforth A, Semper Fidelis D, Hornet D, Herbert, Maclaren's Prolific, Improved Beehive, Norwich Wonder, and Parson's Fillbasket are all recorded as free of disease.

Red Cross was by far the most severely attacked by mosaic, and Duke of Cornwall, Devon, Norwich Wonder, Hornet A, and Pyne's Royal were all fairly severely attacked. Baumforth A, Reader's Perfection, Lloyd George, Semper Fidelis D, Baumforth B, Hornet D, Herbert, Improved Beehive, Maclaren's Prolific, and Parson's Fillbasket all had a negligible amount of mosaic.

Baumforth E and Northumberland Fillbasket both suffered badly from mildew.

879. Swarbrick, T., and **Thompson, C. R. 1931.** Observations upon the incidence of 'reversion' and the control of 'big bud' in black currants. *Rep. Long Ashton Res. Sta.*, pp. 101-11.
No bush of Boskoop, Taylor, or Davison's Eight became reverted in a variety trial planted in 1927-8. French appeared to be the most susceptible variety in the trial.

880. Swarbrick, T., and **Thompson, C. R. 1934.** A comparison of the picking costs of six commercial varieties of black currants. *Rep. Long Ashton Res. Sta.*, pp. 16-23.
In one group the costs per ton for the 5-year period 1930-34 were Baldwin £7 0s. 1d.; Boskoop £5 15s. 5d.; Davison's Eight £7 18s. 7d.; Taylor £12 14s. 6d. The average costs in the other group were Baldwin £6 16s. 3d.; Boskoop £6 2s. 6d.; French £8 16s. 11d., and Edina £8 5s. 7d.

881. Swarbrick, T., and **Berry, W. E. 1936.** Comparative yields of black currant varieties and their response to differential pruning treatment. *Rep. Long Ashton Res. Sta.*, pp. 66-74.
Mean yields in tons per acre for the period 1930-36 inclusive are given for two variety trials: (1) Boskoop 2·61, Baldwin 2·27, Davison's Eight 1·23, and Taylor 1·09; and (2) Boskoop 2·45, 2·34; Baldwin 2·23, 1·96; French 2·78, 2·41; and Edina 2·52 and 2·30. The second figure for each variety in trial (2) is the yield from hard pruned plots, the first figure is for light pruning.

882. Swarbrick, T., and **Berry, W. E. 1936.** Further observations on the incidence and spread of reversion and big bud in black currants. *Rep. Long Ashton Res. Sta.*, pp. 124-32.
It is noted *inter alia* that Edina appeared more susceptible, and Baldwin less susceptible, than French, to reversion.

883. Taronova, E. A., and **Kiece, V. T. 1955.** (Pollination and the yield of black currants.) *Latv. PSR Zināt. Akad. Vestis*, No. 12, pp. 91-8. (From *Plant Breed. Abstr.*, **27**, p. 137.)
At the Pure Research Station the yield and fertility of Lija Plodorodnaja, Boskoop Giant, Neapolitan, and Goliath, (1) self-pollinated or (2) fertilized by large or small amounts of pollen of another variety, were investigated. Good pollinators for each variety are listed.

884. Tatarintzeff, A. S. 1937. (Pollen germination on the stigma in some intergeneric crosses.) (Horticulture by Mičurin's methods. *Bull. Lenin Acad. Agric. Sci. Res. Inst. Fruit Grow. I.V. Mičurin*) No. 4, pp. 18-23. (Condensed from *Plant Breed. Abstr.*, **8,** p. 486.)

A study of pollen germination in reciprocal crosses between Marlboro and Turner raspberries and various strawberries including *Fragaria elatior*. Successful results were obtained in some of the raspberry and strawberry crosses; but in others a considerable reduction in the percentage germination was recorded and it is therefore recommended that in such crosses measures should be taken to provide a suitable environment for the pollen, such as the transference of portions of the stigma of the male parent to the stigma of the female parent.

885. Teaotia, S. S., and **Luckwill, L. C. 1955.** Fruit drop in black currants: I. Factors affecting 'running off'. *Rep. Long Ashton Res. Sta.*, pp. 64-74.

'Running off' and pre-harvest drop together cause 30-50% loss of berries. 'Running off' reaches its peak in the third week after bloom. Pre-harvest drop may cause serious losses if harvest is delayed.

Berries towards the apex of the truss usually have fewer seeds and are more subject to 'running off' than those at the base. There is a high correlation between seed number and berry weight, both between and within positions on the truss.

'Running off' in Seabrook's Black is greatly increased in the absence of adequate pollination, but even with optimal pollination conditions (hand pollination) much 'running off' still occurs. Lack of pollination cannot therefore be considered the primary cause of this phenomenon.

Dropped berries usually contain fewer good seeds because of abortion of fertilized ovules at various stages of development.

886. ter Pelkwijk, A. J. 1950. (A study on varieties of blackberries.) *Meded. Dir. Tuinb.*, **13,** pp. 774-88. (Expanded from *Hort. Abstr.*, **21,** p. 340.)

The classification, propagation, and cytology of blackberries are reviewed and a survey given of: the best known blackberry varieties selected from wild plants; some artificial crosses of blackberries; thornless varieties; and the best known hybrid berries. Himalaya, the only variety worth cultivating in Holland, is insufficiently winter hardy, although healthy and a good yielder. Cultivated brambles are more exposed to cold drying winds than wild plants, which are normally sheltered by other plants. Frost-hardy wild plants should be tested under cultivation before being used as breeding stock.

887. ter Pelkwijk, A. J. 1952. (General outlook for new soft fruit crops.) (General plant breeding meeting 1951.) *Meded. Inst. Vered. TuinbGewass.*, No. 32, pp. 80-91.

ter Pelkwijk, A. J. 1952. *See* **Beijerinck, W.,** and **ter Pelkwijk, A. J.**

888. Thayer, P. 1918. Notes on the nomenclature and classification of currant varieties. *Proc. Amer. Soc. hort. Sci.*, **15,** pp. 65-70.

The following key is abridged from the classification given:

A. Foliage very light green, margin of leaf lighter coloured giving appearance of a narrow edging of white. Leaf-fall late. Fruit red.

London Market

AA. Foliage very dark green, almost black, hanging on until winter. Bush very vigorous, stiff. New shoots bright red in early summer. Fruit late, red.

B. Leaves moderately wide, upper surface glossy. Fruit stems medium to short. Fruit medium-red, late.

Franco-German

BB. Leaves rather narrow, smooth but not glossy. Fruit stems medium to long. Fruit light red, very late.

Rivers Late Red

(Prince Albert and Long Bunch Holland probably belong here also.)

AAA. Foliage variable in colour but neither as light as A nor as dark and rank as AA. Fruit red or white.

B. Thick coarsely veined leaves (*R. vulgare* var. *macrocarpum*).

C. Fruit red:
Cherry, Fay, Filler, Comet, Perfection, Chautauqua, Red Giant, Crawford.

CC. Fruit white:
White Imperial.

BB. Leaves not markedly thick or coarse (*R. vulgare*).

C. Leaves folded or cupped.

D. Fruit red:
Red Dutch, (N. Star), Wilder, Red Grape, Knight Large, Red Pomona.

DD. Fruit white:
White Dutch, White Transparent, Bar le Duc.

CC. Leaves flat or nearly so.

D. Leaves densely pubescent beneath.

E. Fruit red:
Victoria, Dilnots, Scotch.

EE. Fruit white:
White Grape.

DD. Pubescence on lower surface light.

E. Fruit red:
Red Cross, Wilson's Long Bunch.

EE. Fruit white:
White Versailles.

889. Thayer, P. 1923. Raspberry breeding notes. *J. Hered.*, **14,** pp. 12-13.
A wild yellow fruited form of *Rubus occidentalis* pollinated by Golden Queen gave seedlings with pinkish yellow fruit. The reciprocal cross, Golden Queen × *R. occidentalis*, yielded only a few plants. Sterility occurred in seedlings of Ranere × Cuthbert. When Ranere was the female parent only 1 in 7 of the seedlings was sterile, while with Cuthbert as female 11 in every 24 were fruitless.

890. Thayer, P. 1923. The red and white currants. *Bull. Ohio agric. Exp. Sta.*, **371,** pp. 309-94.
Part I of this bulletin, entitled 'A review of horticultural literature', deals with the botany, history and synonymy of varieties; Part II, entitled 'Field studies at Ohio Station', presents descriptive data obtained in an extensive varietal collection.

891. Thomas, C. C. 1936. Leaf-bud propagation of several species of *Rubus*. *Proc. Amer. Soc. hort. Sci.*, **33**, pp. 377-9.
The following species rooted successfully from leaf-bud cuttings: *Rubus armeniaca*, *R. ellipticus*, *R. fraxinifolius*, *R. glaucus*, *R. parvifolius*, and *R. leucodermis*, Brainerd blackberry, Van Fleet raspberry. All of these types root from tip-layers, suggesting that ability to do this is correlated with ability to root from leaf-bud cuttings.

Thomas, H. E. 1948. *See* **Wilhelm, S., Thomas, H. E.,** and **Jensen, D. D.**

Thomas, H. S. 1950. *See* **Wilhelm, S.,** and **Thomas, H. E.**

Thomas, H. E. 1951, *See* **Wilhelm, S., Thomas, H. E.,** and **Koch, E. C.**

Thomas, H. E. 1954. *See* **Wilhelm, S.,** and **Thomas, H. E.**

892. Thomas, P. H. 1947. The Summerleas Horticultural Experiment Station. *Tasm. J. Agric.*, **18**, pp. 175-80.
A new raspberry variety, Neika, is similar to Lloyd George but more upright in habit and more suitable for canning. Unlike Lloyd George, it is not autumn-fruiting.

Thomas, P. T. 1939. *See* **Crane, M. B.,** and **Thomas, P. T.**

893. Thomas, P. T. 1940. The origin of new forms in *Rubus*. III. The chromosome constitution of *R. loganobaccus* Bailey, its parents and derivatives. *J. Genet.*, **40**, pp. 141-56.
The Hailsham berry, *Rubus idaeus* (4*x*) was found to be autotetraploid (iiii), *R. vitifolius* (2n=56) behaves as a doubled allotetraploid, or auto-alloploid $2(v_1v_1v_2v_2)$, producing $v_1v_1v_2v_2$ gametes. When these two forms are crossed a fertile hexaploid, in which chromosome pairing is almost wholly by bivalent formation, is produced. There is thus complete autosyndesis among the gametic chromosomes of the parental forms. This hybrid agrees in cytological behaviour with the loganberry, and its origin is taken as reconstructing the history of the loganberry. The loganberry therefore has the chromosome constitution $v_1v_1v_2v_2$ii and since pairing is by autosyndesis the gametes produced will all be v_1v_2i. The differentiation between the v_1 and v_2 genomes is shown by the failure of pairing in the tetraploid hybrid, loganberry × *R. idaeus* (2*x*) ($v_1v_2$ii). If we substitute chromosomes of *R. niveus* (2*x*) or *R. neglectus* (2*x*) for *R. idaeus* in hybrids with the loganberry, meiotic instability is further increased. This shows that non-pairing in the loganberry × *R. idaeus* hybrid is due to non-autosyndesis among *vitifolius* chromosomes (v_1v_2) and not to non-pairing among *idaeus* chromosomes, i.e. those already in the loganberry gamete and those brought in from outside. Evidence suggests that the i set of chromosomes in the gamete of the loganberry is closely related to either the v_1 or v_2 set derived from *R. vitifolius*. Trivalents are formed in the hybrid loganberry × *R. idaeus* (2*x*) ($v_1v_2$ii) and the number of univalents in the hybrid *R. vitifolius* × *R. idaeus* (2*x*) ($v_1v_1v_2v_2$i) may be as low as three. Support for this suggestion is obtained from the close association observed by Darrow and Longley in a haplopolyploid parthenogenetic loganberry (v_1v_2i). Thus the chromosome behaviour of the loganberry, of its supposed parents, and of its crosses with them is consistent with its supposed hybrid origin.

894. Thomas, P. T. 1940. Reproductive versatility in *Rubus*. II. The chromosomes and development. *J. Genet.*, **40**, pp. 119-28. (Author's summary.)

Apomictic modes of reproduction were detected in *Rubus* by combining somatic and meiotic studies with embryological studies. Apospory, i.e. development from a purely vegetative embryo sac, is the general method of non-sexual reproduction in the species examined. Exceptional behaviour may occur within the sexual embryo sac, such as (*a*) fusion of haploid nuclei, (*b*) presence of two differentiated eggs and one synergid, or (*c*) presence of three undifferentiated nuclei at the micropylar end. These abnormalities will account for the segregation of characters among asexual progeny which was observed by Crane (1940). Comparison of the developmental processes with genetical behaviour in six polyploid species of *Rubus* shows that a transition from a completely sexual to completely apomictic mode of reproduction is correlated with a transition from allopolyploidy to autopolyploidy. The condition determining apomixis in *Rubus* thus seems to be sexual infertility following autopolyploidy. The work of Lidforss, in which two different pseudogamic tetraploids when crossed always yield sexually reproducing allopolyploids, agrees with this view [cf. Gustafsson, 1942].

Thomas, P. T. 1941. *See* **Crane, M. B.,** and **Thomas, P. T.**

Thomas, P. T. 1949. *See* **Crane, M. B.,** and **Thomas, P. T.**

Thompson, C. R. 1931. *See* **Swarbrick, T.,** and **Thompson, C. R.**

895. Thompson, C. R. 1933. Raspberry varieties. An identification key and notes on varietal characters. *Rep. Long Ashton Res. Sta.*, pp. 48-59.

A key is given to the classification of 29 raspberry varieties of which only some half-dozen now exist. Descriptive notes on canes, leaves and fruit are given for each variety.

Thompson, C. R. 1934. *See* **Swarbrick, T.,** and **Thompson, C. R.**

Thung, T. H. 1951. *See* **Fluiter, H. J. de,** and **Thung, T. H.**

896. Thung, T. H. 1952. (Observations on *Rubus* stunt in raspberry and wild blackberry. II.) *Tijdschr. PlZiekt.*, **58**, pp. 225-59.

897. Tischler, G. 1906. (On the development of pollen and tapetal cells of *Ribes* hybrids.) *Jahrb. Wiss. Bot.*, **42**, pp. 545-78.

The cytology of the *Ribes* hybrids, *R. schneideri* (*R. grossularia* × *R. nigrum*), *R. gordonianum* (*R. aureum* × *R. sanguineum*) and *R. intermedium* (*R. sanguineum* × *R. nigrum*) is described. The first two are sterile, the third is fertile. *R. gordonianum* occasionally showed double spindles during PMC meiosis and slightly uneven distribution of chromatin to the poles, together with extrusion of chromatin elements into the cytoplasm. In the other two hybrids chromosome behaviour was usually normal. The author concludes that sterility is probably not due to irregularities in chromosome behaviour, except sometimes in *R. gordonianum*, but to nutritional disturbances affecting the whole flower.

898. Tischler, G. 1927. (Chromosome studies of *Ribes gordonianum* and its parents.) *Planta*, **4**, pp. 617-50.

Ribes sanguineum chromosomes are larger than those of *R. aureum* and this size difference is maintained in the F_1 hybrid *R. gordonianum*. In PMC meiosis of the hybrid, each parental set pairs *inter se* [cf. Meurman, 1928]. The smaller *aureum* chromosomes move more slowly to the poles than those of the *sanguineum* parent, but are usually included in the main nuclei, supernumerary nuclei being rare. No viable pollen is formed due to meiotic irregularities and other external factors. Three examples of restitution nuclei with 16 chromosomes were seen after the first PMC division. The following species were found to have n=8 chromosomes: *R. rubrum*, *americanum*, *petraeum*, *sanguineum*, *aureum*, *nigrum*, *cereum*, *lacustre*, *grossularia*, *divaricatum*, *setosum*, and *alpinum*.

899. Tischler, G. 1928. (On the unique chromosome pairing in *Ribes gordonianum* (*sanguineum*×*aureum*).) *Z. indukt. Abstamm- u. VererbLehre*, **46**, p. 55.

A summary of a paper presented at a botanical congress, Ithaca. Although the chromosomes of *R. sanguineum* are not much larger than those of *R. aureum*, the respective parental sets can be distinguished in somatic tissue and in meiosis of the F_1 hybrid *R. gordonianum*. Normal diakinesis does not occur in the hybrid, the chromosomes lying end to end in the nucleus. However, at late diakinesis and at metaphase, some bivalents are formed, in some cases almost all the chromosomes pairing. Chromosomes of equal size pair showing that intra-parental chromosome pairing occurs [cf. Meurman, 1928]. At anaphase, the larger *R. sanguineum* chromosomes move to the poles more rapidly than those of *R. aureum*. Supernumerary chromosomes in the cytoplasm are not apparent.

Three restitution nuclei with 16 chromosomes were seen, but no diploid pollen was observed.

Apparently polyploidy does not occur in *Ribes*. Twelve species from five of the six sections have a haploid number of n=8.

900. Tischler, G. 1928. (On the peculiar chromosome pairing of *Ribes gordonianum*.) *Z. indukt. Abstamm.- u. VererbLehre*, *Suppl.* **2**, pp. 1487-94.

901. Todhunter, E. N., and **Robbins, R. C. 1939.** Varietal differences in vitamin C (ascorbic acid) content of frozen red raspberries. *Rep. Wash. St. agric. Exp. Sta.*, **49**, p. 40.

Antwerp contained 0·35 mg. of vitamin C per g. of fruit, whereas Marlboro, Tahoma, Latham, Lloyd George, and Cuthbert contained from 0·14 to 0·18 mg. per g.

902. Tolmačev, I. A. 1940. (An experiment on overcoming incompatibility.) *Jarovizacija*, No. 5 (32), pp. 125-6. (Adapted from *Plant Breed. Abstr.*, **11**, p. 321.)

The Crandall currant (*Ribes odoratum* Wendl.) was pollinated with mixed pollen of various gooseberry varieties and with pollen of individual varieties, after having the stigma and part of the style cut off (the style is otherwise too long to permit of effective fertilization). Seed was obtained only from pollination with pollen mixtures. The operation of cutting off the stigma alone did not result in the set of parthenocarpic fruit. Of the 6 seedlings that survived, 5 were intermediate in character and 1 was

matroclinous. The spine development in the hybrid plants varied according to season, being more pronounced under dry conditions and almost absent under wet.

903. Tolmačev, I. A. 1941. (Hybrids of Crandall-currant with black currant.) *Vestnik Gibridizacii* (Hybridization), No. 1, p. 115. (Condensed from *Plant Breed. Abstr.*, **12,** p. 278.)
Crandall currant (*Ribes odoratum*) was pollinated with black currant and gave vigorous hybrids which flowered in the fourth year.

904. Tubeuf, C. v. 1933. (Studies on symbiosis and tendency to parasitic infection and on the inheritance of pathological characters in our woody plants. IV. The tendency of the five-needled species of pine, on the one hand, and of the various genera, species, hybrids, and horticultural forms of *Ribes*, on the other, to attack by *Cronartium ribicola*.) *Z. PflKrankh.*, **43,** pp. 433-71.
On the basis of five years' experiments in Germany and of a study of relevant literature, the writer surveys varietal response to *Cronartium ribicola* of currants, gooseberries, and other species of *Ribes*. Types found to be more or less immune in Germany as in America were *R. alpinum* L. and *R. houghtonianum* Jancz. as represented by Red Dutch and its derivatives Eyath Nova, Franco-German, Holland-Redpath, Rivers and Simcoe King. Varieties tested only in Germany and found to be immune were: *Ribes sativum* var. *macrocarpum*—Birnförmige Weisse, Rote Kernlose, Hochrote Früher; *R. rubrum glabellum*; *R. pallidum*—Gögingers Birnförmige, Weisse Burgdörfer; *Grossularia pinetorum*, Cov. et Britt; *G. acicularis* (Sm.) Spach.; *G. stenocarpa* (Max.) Berg.; *G. diacantha* Pallas; *G. pulchella* Turcz.; *G. giraldii* Jancz.; *G. glacialis* Wall.; *G. cynosbati* (L.) Mill.; *G. orientalis* Desf.; Mertens Gebirgs-stachelbeere Späte Grüne. Other species and varieties showing a degree of resistance to *Cronartium* were: *R. innominatum*, *R. americanum*; Earliest of Fourlands; *G. leptantha* (A. Gray) Cov. et Britt.; *R. lurida* Hookf. et Thoms.; Apollo Gibston; Black Seedling Pausner.

Seedlings [whether from selfed seed or not was not stated] of the following were immune: Houghton Castle, Gögingers Birnförmige, Rote Kernlose, Hochrote Frühe, Earliest of Fourlands, *G. diacantha*, Black Seedling.

Seedlings of *Ribes stenocarpum* and Späte Grüne were infected, although the parents were immune.

Types producing susceptible seedlings were *R. rubrum* L., *R. koehneanum*, *R. aureum*, Pomona Kaukasische, Rote Süsse, London, Weisse von Verrières, *G. rustica*, *G. oxyacanthoides leucodermis*, *G. divaricata*, *G. innominata*, and *G. magellanica*.

In a brief section describing the spread of American gooseberry mildew (*Sphaerotheca mors uvae*) in Germany in the previous 30-40 years, it is stated that the following varieties showed no infection in 1931 and 1932: American Gebirgs-Stachelbeere, Bumper, Mad. Lefort, Monstreuse, Oakmere, Octavius Brown, Profit, Stangthermann, Weisse Kristallbeere.

905. Tubeuf, C. v. 1935. (The execution of the organized practical control of blister rust of five-needled pines.) *Z. PflKrankh.*, **45,** pp. 297-301.
The eradication of black currants, *Ribes aureum* and other susceptible varieties is recommended; the immune Red Dutch currant may be planted with impunity.

906. Tucker, L. R. 1933. Seasonal tests of the fruits of raspberry varieties. *Proc. Amer. Soc. hort. Sci.*, **29**, pp. 306-12.

Tests made in 1932 at intervals throughout the harvest season during which very little rain fell are tabulated below.

Variety	*Average berry wt. (g.)*	*Average no. drupelets per berry*	*Average drupelets wt. (mg.)*	*Average no. seeds per g. of berry*
Cuthbert ..	1·447	66·2	22	46·0
Latham ..	2·042	60·1	34	29·4
St. Regis ..	1·039	45·7	23	44·0
King ..	1·333	48·1	28	36·1
Cumberland	1·401	75·2	19	53·7
Gregg ..	1·272	70·7	18	55·6
Kansas ..	1·292	69·3	19	53·6

Early in the season the black raspberries contained a higher percentage of soluble solids than the reds and this difference was increased in the later maturing fruits owing to an increased soluble solid percentage in the blacks.

907. Tukey, H. B. 1924. Studies of fruit seed storage and germination. *Bull. N.Y. St. agric. Exp. Sta.*, **509**, pp. 3-19.

Work on blackberry, raspberry, currant, and gooseberry showed that the gooseberry alone was able to germinate readily after subjection to cool moist conditions. Treatment with sulphuric acid increased the percentage of germination in all fruits except the gooseberry, whose seeds were killed by 15 min. immersion. With the blackberry, increased germination resulted from 4 hrs acid treatment.

908. Turnbull, J. 1950. Identification of black currant varieties. *J. hort. Sci.*, **25**, pp. 175-80.

The following key has been taken from the paper more or less unchanged:

Key to black currant varieties in late June and early July

A. Stems coloured; petioles usually coloured, occasionally green.

Leaves of fine texture, regular, acute, appearing long; sinus usually deep .. .. *Baldwin*

Like Baldwin but sinus not so deep and serrations rather sharp. Occasional variegation. Some late fruit .. .. *Daniel's September* (Baldwin sport)

Habit of Boskoop. Leaves nearer Baldwin when growth weak but nearer Boskoop when growth strong. Stem brownish pink, no bloom, shiny .. .. *Wellington XXX* (Baldwin × Boskoop)

Habit nearer Baldwin. Purplish pink stem with bloom. Leaves short, coarse, soft, dull, greyish .. .. *Mendip Cross* (Baldwin × Boskoop)

Dark stem, darker petioles. Long, narrow, pointed coarse leaf, sometimes dished; deep sinus .. .. *Laxton's Giant* (Baldwin × Boskoop)

Leaf nearer Baldwin than Boskoop; rugose; long terminal lobe; sinus medium .. .. *Laxton's Grape* (Baldwin × Boskoop)

Leaf appears very long, surface flat (not wrinkled), blade as a whole often upfolded; sinus shallow; serrations deep and acute
Westwick Choice
(Baldwin × French)

Flat Baldwin leaf; medium sinus; all lobes very pointed; serrations very deep and acute .. .. *Blacksmith*
(Baldwin × French)

Leaf nearer French than Baldwin .. Four little-known varieties
(Baldwin × French)

Many double growths. Leaves crowded at top of shoot; large, long, pointed, upfolded, wavy edges, very rugose; deep sinus
Malvern Cross
(Baldwin × Goliath)

Long narrow leaves, small serrations. Often cupped at stem end
Nigger
(Baldwin × Goliath)

B. Stems greenish; petioles pale.

Leaves convex, very irregular, rather short, serrations small; sinus medium. Old leaves dark and shiny .. .. *Goliath*

Leaves green, smooth, dull, short; sinus deep; surface raised between veins; many small acute serrations .. .. *Cotswold Cross*
(Goliath × Baldwin)

Leaves acute, fine veined, dull; sinus less deep, *not* pointed at stem end
Davison's Eight
(Goliath × Baldwin)

Short greyish leaf; deep sinus; not very rugose. Habit like that of a red currant bush .. .. *Standard*
(Goliath × Baldwin)

Grey-green coarse leaves; very deep sinus .. .. .. *Raven*
(Goliath × Boskoop)

Leaf of Goliath shape but domed; occasional rounded lobes. Old leaves leathery, shiny .. .. *Westwick Triumph*
(Goliath × French)

Narrow pointed Goliath-French leaves, rugose, rather shallow sinus
Matchless
(Goliath × French)

C. Stems green; petioles pink or with pink markings.

Leaves large and coarse, lobes obtuse; sinus very deep, not pointed
Boskoop

Young leaves not unlike Baldwin, but sinus shallow or flat. Old leaves flat, squarish, dark, leathery .. .. *French*

Very strong upright growth. Bright red at base of petioles (when it develops). Very large long leaves. Old leaves dark and leathery. Reminiscent of Boskoop and French. Known in Scotland as Baldwin Rogue. Valueless and should be eliminated .. .. .. *I.G.P. Rogue*
(Boskoop × French)

Hatton (1920) recognized four varieties of black currant: Baldwin, Boskoop Giant, French, and Goliath. The remainder were almost indistinguishable from one or other of these, presumably because these four varieties come nearly true from seed. The above key extends Hatton's work to cover the newer hybrid varieties from intercrossing these basic four.

Turner, E. 1927. *See* **Muskett, A. E., and Turner, E.**

909. Tydeman, H. M. 1930. Some results of experiments in breeding black currants. I. The self-pollinated families. *J. Pomol.*, **8,** pp. 106-28.

Observations, over seven years, on first and second generation selfs of the chief varieties of black currants are summarized and discussed. The inheritance of bud colour and form, season of leaf break and fruit maturity, length of fruiting racemes, size, flavour and texture of fruit is dealt with. Such characters were transmitted without material modification through two generations.

Boskoop Giant, Goliath and Baldwin, when selfed, produced progenies with leaves similar to the parental type. French Black progenies gave 'normal' to 'B' type leaves in the ratio of 3: 1 and Seabrook's Black and Siberian when selfed gave 9: 3: 4 ratios of normal (genotype SR) to Sr leaf type to sR plus sr leaf type. These leaf types are defined and illustrated. 'B' leaves were more attenuated and pointed, the serrations were markedly more acute and invariably innervated, and the extremity of the terminal lobe frequently showed a filamentous extension of the midrib. Type Sr was morphologically similar to 'B'. Type sR had rather rounded leaves and type sr was a more extreme form of sR with dark green almost round leaves which ranged down to leaves shaped rather like hollow cones. sR and sr plants were found to have shorter fruiting racemes than normal and Sr plants. In vigour, normal plants and type 'B' (or Sr) appeared equal but sR seedlings were less vigorous and had whippy, slender growth while sr bushes were in many cases definite dwarfs.

910. Tydeman, H. M. 1938. Some results of experiments in breeding black currants. II. First crosses between the main varieties. *J. Pomol.*, **16,** pp. 224-50.

A survey of the inheritance of a number of characters in twenty crosses between commercial black currant varieties. Tydeman's (1930) interpretation of the inheritance of leaf characters as due to the genes S and R is confirmed. Data are presented suggesting that season of coming into leaf is controlled by two additive genes [for which no symbols are suggested], late plants being the bottom recessives. Segregation for bud shape agreed closely with the hypothesis that plants with conical buds are heterozygous for two dominant genes and that round buds represent the bottom recessive phase. Crosses of plants having long racemes with plants having medium racemes gave 120 long: 181 medium: 41 short; medium × medium gave in F_1 51: 164: 68; medium × short gave 15: 177: 126; and long × short gave 15: 67: 27.

These intervarietal crosses gave no instances of striking advances in commercial characters and it is considered that the breeder will have to look outside *R. nigrum* to obtain major improvements in such characters as raceme length and fruit size. None of the hybrids possessed the four fruit characters long racemes, large berries, sweet flavour, and tough skins. Long racemes and large berries occurred together in about 1% of the plants, and long racemes combined with tough skins occurred in 2% of the plants. The three characters long racemes, large berries and sweet flavour occurred together in less than 0·2% of the plants.

Attention is drawn to *R. longeracemosum* from Tibet with its 12-18 in. racemes and large, black, good flavoured berries. Hybrids of Baldwin × *longeracemosum* have, however, remained sterile for seven years.

Attempts to induce mutations by treating seeds, ovules and pollen with X-rays proved ineffectual.

911. Tydeman, H. M. 1949. Amos Black: a promising new black currant variety. *Rep. E. Malling Res. Sta. for 1948*, p. 82.

Amos Black, from the cross Goliath × Baldwin made in 1926, resembles Baldwin but ripens about a fortnight later. Its lateness in flowering often confers frost avoidance. The fruits are larger than those of Baldwin and their tough skins should enable them to travel without damage.

912. Vaarama, A. 1939. Cytological studies on some Finnish species and hybrids of the genus *Rubus* L. *Maataloust. Aikakausk.*, **11**, pp. 72-85.

The somatic chromosome numbers for five species and three hybrids of *Rubus* were as follows: *R. caesius* L., 28; *R. idaeus* v. *anomalus* Arrh. (=*R. obtusifolius* Willd.), 14; *R. saxatilis* L., 28; *R. arcticus* L., 14; *R. humulifolius* C. A. Mey., 28; (1) *R. saxatilis*×*arcticus*, 21; (2) *R. caesius*×*idaeus*, 21; and (3) *R. caesius*×*saxatilis*, 28.

All five species contain one pair of chromosomes with satellites and one pair was seen in hybrid (3), but only one chromosome with a satellite was seen in hybrids (1) and (2). *R. caesius* and *R. saxatilis* are probably hybrids in origin because although they are tetraploids they contain only one pair of characteristically long chromosomes with three constrictions and only one pair of chromosomes with satellites.

PMC meiosis in the hybrid *R. caesius* × *R. idaeus* (2n=21) is irregular with 4-7ii at MI. Lagging univalents of the first and second divisions may form small deformed pollen grains. Meiosis in the hybrid *R. caesius*×*R. saxatilis* (2n=28) is even more irregular with 0-7ii at MI. Allosyndesis probably occurs and the members of bivalents are often unequal in size.

Chromosome homology as shown by bivalent formation is closer between *R. caesius* and *R. idaeus* than between *R. caesius* and *R. saxatilis*.

913. Vaarama, A. 1947. Morphological and cytological studies on colchicine induced tetraploid *Ribes nigrum*. *Suom. Maataloust. Seur. Julk.*, **67**, pp. 55-92.

The threshold value for c-mitosis in treating root tips of *Ribes nigrum* with colchicine was found to be 0·014%. Five autotetraploid plants were obtained by treatment of the growing tips of seedlings. Seed formation in the tetraploid was reduced to 23-58% of that of the diploid, flowering was earlier and the fruit had a stronger flavour; ascorbic acid was less in the juice but more when expressed as percentage dry weight (presumably due to fewer seeds).

At MI univalents, bivalents, trivalents and quadrivalents occur together with some configurations of a higher order. The chiasma frequency is lower than in the diploid. Possible reasons for the lack of natural polyploids and aneuploids in *Ribes* are discussed.

914. Vaarama, A. 1948. A triple species hybrid in the genus *Ribes*. *Hereditas, Lund*, **34**, pp. 369-70 (Abstr.).

A hybrid of *R. culverwellii* × *R. alpinum* var. *pumilum* was obtained. *R. culverwellii* is itself a hybrid of *R. nigrum* and *R. grossularia* and is normally sterile. An attempt to cross the triple hybrid with *R. nigrum* failed.

915. Vaarama, A. 1948. Cryptic polyploidy and variation of chromosome number in *Ribes nigrum*. *Nature, Lond.*, **162**, p. 782.

A more detailed account appears under Vaarama, 1949b.

916. Vaarama, A. 1949. Cytogenetic studies on two *Rubus arcticus* hybrids. *Maataloust. Aikakausk.*, **20,** pp. 67-79.

In the hybrid *R. idaeus* × *R. arcticus* the chromosome number was 2n=14. In 83·4% of the meiotic divisions studied in the F_1, pairing was complete and 7_{II} were formed. In 10·6% of the cells 6_{II} and 2_I were observed; in 6·0% one bivalent showed abnormal division. The second division was regular. PMC meiosis in the F_2 was normal. The chromosome number of *R. saxatilis* × *R. idaeus* was 2n=21. In meiosis of the first generation of this hybrid, varying numbers of univalents, bivalents, and trivalents were seen; the latter sometimes formed inversion bridges and were delayed in their division so that some chromosomes were eliminated. The second division was less irregular. The hybrid showed complete sterility obviously haplontic in character.

The F_1 *R. idaeus* × *R. arcticus* was highly sterile, due it is suggested to seasonal haplontic sterility. In the F_2 fertility was restored by segregation, and there was marked segregation of parental characters.

It is suggested that *R. arcticus* and *R. idaeus* were probably differentiated from a common ancestor by a gene or chromosome mutation causing seasonal sterility, and that speciation then continued mainly through gene mutation.

917. Vaarama, A. 1949. Spindle abnormalities and variation in chromosome number in *Ribes nigrum*. *Hereditas, Lund*, **35,** pp. 136-62.

A number of colchicine-induced tetraploid *Ribes nigrum* bushes (2n=32) and their C_2 progeny have been studied. Somatic chromosome numbers ranged in individual cells from 4 to 32. The formation of two separate and independent spindles is the cause of the diminution of the chromosome number. The diploid number was the most frequent but all chromosome numbers divisible by four were more frequent than might have been expected on a random basis. It is concluded that 4 and not 8 is the basic number in *Ribes*.

918. Vaarama, A. 1949. Permanent effect of colchicine on *Ribes nigrum*. *Proc. 8th int. Congr. Genet. Stockh.* (*Suppl. Hereditas*), pp. 680-1 (Abstr.).

An examination was made of a number of bushes of *Ribes nigrum* which had remained diploid despite colchicine treatment. In somatic divisions no disturbances were found, but in the first meiotic metaphase the following irregularities as compared with the normal diploid, were observed: displaced and stretched, often bent, spindles; split spindles, which may be multipolar; incompact spindles; unipolar spindles. In chromosomes there were observed: non-orientation of centromeres; non-congression of the chromosomes on the metaphase plate; deletions; translocations; unequal bivalents; fragments; multivalents; and univalents. In addition, the worst affected anther lobes showed cytomixis. In this case also the wall formation between PMCs is incomplete, the cells being connected by numerous channels.

The irregularities are somewhat similar to those seen in cell division after weak X-ray treatment as well as in meiosis after treatment with mustard gas. It is concluded that colchicine gives rise to permanent changes in the chromosomes but that the effect is rather weak and is only seen in meiosis. It seems probable that it is the centromere which is chiefly affected.

919. Vaarama, A. 1951. (On interspecific hybridization as a breeding method within the genus *Rubus*.) *Nord. JordbrForskn.*, **31-32,** pp. 412-17 (Condensed from *Plant Breed. Abstr.*, **22,** p. 286.)

Referring to the distribution of *Rubus arcticus* and related forms in the arctic and subarctic tracts of N. America, as well as in Fennoskandia and Finland proper, the author points to the possible importance of Asiatic and other forms in breeding work in progress at Piikkiö, Finland. Extensive interspecific hybridization has been carried out. Crosses of *R. idaeus* with *R. arcticus* show that the ancestral forms of *Idaeobatus* and *Cylactis*, from which these species derive, have evolved mainly through gene and not genome mutations.

The causes of regional and seasonal sterility in *Rubus* are discussed. Defective pollen germination appears to be a contributory factor; meiotic disturbance is not uncommon.

Although some seeds of F_1 plants of *R. idaeus* × *R. arcticus* carry sublethal gene combinations and such plants remain dwarf and die the next summer, 30-40% of the seed sown produces viable individuals. Fertility rises markedly in the F_2. Aroma is conditioned by a complex of genes, but some new types have appeared with a predominant bitter-sour flavour. Following colchicine treatment, one amphidiploid plant was obtained in the F_2.

Two triple hybrids, *R. phoenicolasius* × *R. caesius* × *R. arcticus* and *R. phoenicolasius* × *R. caesius* × *R. saxatilis* have been obtained.

A tetraploid *R. plicatus*, found in the Finnish collection, fruits abundantly and is so early that it ripens in southern Finland even in unfavourable years. Its value in a cross with the raspberry is being tested.

920. Vaarama, A. 1953. Cytology of hybrids between Pacific *Rubi Ursini* types and an eastern blackberry. *Amer. J. Bot.*, **40,** pp. 565-70.

Microsporogenesis was studied in four hybrids, which arose when $6x$, $8x$, and $10x$ members of the Pacific Coast *Rubus ursinus* complex, as well as the loganberry, were crossed with $4x$ Macatawa of eastern blackberry type. Macatawa is an autotetraploid with high frequency of quadrivalents. The pentaploid hybrids, *R. loganobaccus* × Macatawa and *R. ursinus* ($6x$) × Macatawa, are characterized by a fairly high multivalent (quadri- and tri-valent) formation. In the hybrids *R. ursinus* ($8x$) × Macatawa and *R. ursinus* ($10x$) × Macatawa the percentage of multivalents is clearly reduced. It is assumed that the larger number of homologous sets present in the latter hybrids favours preferential pairing in PMCs and decreases the relative amount of multivalents. The hybrids *R. ursinus* ($6x$) × Macatawa and *R. ursinus* ($8x$) × Macatawa are characterized by an irregular meiosis. The irregularities are not apparently correlated with oddness of ploidy. The observations suggest that chromosomes of all different sets present in the genomes are homologous enough for pairing in all combinations. For that reason it is suggested that differentiation between the chromosomes of various *Rubus* genomes has taken place mainly through gene mutations and minor structural changes not sufficient to disturb the pairing capacity of chromosomes. Where, however, the conditions for preferential pairing are favourable, the existing differences become effective.

921. Vaarama, A. 1953. The effect of aneuploidy upon the progeny of an autotetraploid *Ribes nigrum*. *Maataloust. Aikakausk.*, **25,** pp. 77-83.

Morphological and developmental characteristics of a total of 139 even tetraploid (2n=32), hypo- (2n=31) and hyper-tetraploid (2n=33 and 34) *Ribes nigrum* plants derived from colchicine induced autotetraploid parents have been under observation from the seedling stage to full maturity. A statistical comparison of different chromosome classes was made to reveal possible phenotypic effects of aneuploidy on the species. As the progeny developed, most hypo-tetraploid plants were eliminated.

The effect of aneuploidy was to be seen only in some developmental characteristics of hyper-tetraploid plants. The effect was very slight in $4x+1$ types but more pronounced in the $4x+2$ group; it consisted in a tendency to a slower growth rate during the active growth period of the plants, coupled with a tendency to later flowering. Hyper-tetraploid populations also show an increased proportion of exceptional, long and short, growth periods. The vigour of monoploid ($4x$—1) types was fully maintained, the growth rate being even increased as compared with normal tetraploids.

922. Vaarama, A. 1954. Chromosome numbers of some species and hybrids of the genus *Rubus*. *Arch. Soc. zool. bot. fenn. Vanamo*, **8** (2), pp. 192-5.

The following species are recorded as having 14 somatic chromosomes: *Rubus crataegifolius*, *flosculosus*, *giraldianus*, *inopertus*, *lasiocarpus* (=*niveus*), *parviflorus*, *pubescens*, *simplex*, *stellatus* and *strigosus*, this last named being a wild specimen.

The following species proved to be tetraploid (2n=28): *R. saxatilis* and *R. tephrodes*. *R. chamaemorus* had 2n=56.

Amongst hybrid types the following had 2n=14: (*occidentalis*×*strigosus*)×*arcticus*; *phoenicolasius*×*arcticus*; *phoenicolasius*×(*idaeus*×*arcticus* F_2); *phoenicolasius*×*idaeus* (Miranda); (*phoenicolasius*×*idaeus*)×*odoratus*.

R. saxatilis×*arcticus* and *R. idaeus*×*caesius* F_2 had 2n=28, but the latter was from an open pollinated triploid parent.

923. Vaarama, A. 1954. A contribution to the genetics of *Ribes sativum* Syme. *Arch. Soc. zool. bot. fenn. Vanamo*, **8** (2), pp. 115-16.

A ratio of 7 white: 5 red plants occurred in the progeny of a Red Dutch (*Ribes sativum*) plant grown in isolation (except for a red sister seedling). This is interpreted as the result of the action of two independent dominant genes R and P for red colour and of an independent inhibitor, K and I, for each of these colour genes. It is presumed that the red berried sister plants were of RrkkppIi and rrKkPpii constitution and that the 13 plants in the progeny resulted from the crossing of these two plants. This same progeny also gave normal and ascid type leaves in a 3:1 ratio, thus agreeing with Tydeman's (1930) results in *R. nigrum*. Dwarf plants also occurred in the progeny.

924. Vaile, J. E. 1942. Winter injury and hardiness in brambles. *Bull. Ark. agric. Exp. Sta.*, **417**, p. 29.

During the years 1936-41, the erect blackberry was most resistant to winter injury and black and red raspberries most susceptible. Between these two extremes, in order of decreasing resistance, were the semi-erect blackberry, dewberry and purple raspberry.

van der Meer, F. A. 1952. *See* **Fluiter, H. J. de, and van der Meer, F. A.**

van der Meer, F. A. 1953. *See* **Fluiter, H. J. de,** and **van der Meer, F. A.**

925. van der Meer, F. A. 1954. (On the incubation period of *Rubus* stunt in different raspberry varieties.) *Tijdschr. PlZiekt.*, **60,** pp. 69-73. (From *Plant Breed. Abstr.*, **24,** p. 460.)
Of fifteen varieties tested at Breda, Netherlands, in 1951, Lloyd George, Malling Promise and Taylor proved least susceptible to *Rubus* stunt.

van der Meer, F. A. 1955. *See* **Fluiter, H. J. de,** and **van der Meer, F. A.**

926. Van Meter, R. A., and **French, A. P. 1943.** Nature of winter hardiness in raspberries. *Bull. Mass. agric. Exp. Sta.*, **398,** p. 51.

Van Meter, R. A. 1944. *See* **Bailey, J. S., French, A. P.,** and **Van Meter, R. A.**

927. Vavilov, N. I. 1931. Wild progenitors of the fruit trees of Turkistan and the Caucasus and the problem of the origin of fruit trees. *Proc. 9th int. hort. Congr.*, London, pp. 271-86.

928. Vîksne, A. 1931. (On the experimentally produced hybrid *Rubus idaeus* L. ♀ × *R. saxatilis* L. ♂.) *Acta Hort. bot. Univ. Latv.*, **6,** pp. 84-5.
Rubus idaeus × *R. saxatilis* ♂ hybrids resembled *R. saxatilis.*

929. Vîksne, A. 1931. (Preliminary communication on crosses with *Ribes* (1924-31).) *Acta Hort. bot. Univ. Latv.*, **6,** pp. 86-9. (From *Plant Breed. Abstr.*, **3,** p. 75.)
Forty-four crosses were made with twenty-two different forms; of these only eight gave well developed hybrids, the rest either set no fruit or the seeds failed to germinate. The following crosses were successful: *R. nigrum* L. × *R. aureum* Pursh., *R. grossularia* L. × *R. utile* Jancz. and the reciprocal, *R. utile* Jancz. × *R. niveum* Lindl., *R. rotundifolium* × *R. niveum*, *R. rubrum* hort. (= *R. pallidum* Otto and Dietr.) × *R. nigrum* and the reciprocal, and *R. nigrum* cult. × *R. grossularia* cult.

930. Voluznev, A. G. 1948. (On self fertility of black currants.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 8, pp. 33-4. (From *Plant Breed. Abstr.*, **19,** pp. 393-4.)
Pollination experiments conducted at the White Russian Fruit and Vegetable Research Station showed that the black currant varieties Kent, Davison's Eight, Laxton, and Lija Plodorodnaja were self fertile. The fertility was, however, improved by artificial pollination with pollen of the same varieties from other bushes and still further increased by open cross pollination. Comparative values of the varieties as pollinators for one another are tabulated.

931. Voluznev, A. G. 1955. (New varieties of soft fruits from White Russia.) *Sad i Ogorod* (Fruit and Veg. Gdns), No. 10, pp. 43-6. (From *Plant Breed. Abstr.*, **26,** p. 295.)
Black currant. Belorusskaja Pozdnjaja and Barhatnaja, both obtained at

Minsk by crossing Kent with a wild Siberian form, are distinguished by high yield, large sweet fruit, and resistance to anthracnose.

Gooseberry. Jarovoĭ, Izumnyĭ and Ščedryĭ, the first a seedling, the others intervarietal hybrids, are all characterized by *Sphaerotheca* resistance, hardiness, productiveness and large fruit. Ščedryĭ is late; the others are early.

Waldo, G. F. 1932-33. *See* **Darrow, G. M.,** and **Waldo, G. F.**

932. Waldo, G. F. 1934. Fruit bud formation in brambles. *Proc. Amer. Soc. hort. Sci.*, **30,** pp. 263-7.

Ranere, Lloyd George, Cuthbert, Newburgh, Latham, Chief, Viking, Marlboro, and Antwerp showed definite fruit bud differentiation by late autumn or earlier. Fruit bud differentiation begins with the terminal buds and proceeds downwards in red raspberries. Black and purple raspberry varieties together with *Rubus coreanus*, *R. biflorus*, *R. lasiostylus*, *R. leucodermis*, and *R. canadensis* all showed differentiation in autumn. Oregon Evergreen, Youngberry, loganberry, Ideal Wild, Santiam, Mammoth, wild *Rubus macropetalus*, Lucretia, and Austin Thornless all showed differentiation in early autumn but Himalaya did not show it until January or February.

Waldo, G. F. 1934. *See* **Darrow, G. M.,** and **Waldo, G. F.**

933. Waldo, G. F. 1935. Fruit bud formation in small fruits and its relation to cultural practices. *Proc. annu. Mtg Ore. St. hort. Soc.*, pp. 75-81. (Condensed from *Hort. Abstr.*, **6,** p. 251.)

Red raspberries.—Fruit bud differentiation is progressive from the upper part of the cane downward. In seven varieties examined, buds in the upper parts of the canes were fully differentiated by mid-September. In the lower portions of the canes some varieties formed fruit buds during November to March, whereas others showed no definite differentiation before early March.

Black and purple raspberries.—Fruit bud formation tends to start in the terminal parts of the canes, but the tendency is less marked in purple, and still less in black than in red raspberries. In black raspberries differentiation occurred from mid-September onwards in Oregon.

Dewberries and blackberries.—Fruit bud differentiation begins between mid-September and the end of January, depending on variety and locality.

Gooseberries and currants.—In New York differentiation in the Houghton gooseberry began on 16 August; red currants were somewhat earlier.

934. Waldo, G. F., and **Darrow, G. M. 1941.** Breeding autumn-fruiting raspberries under Oregon conditions. *Proc. Amer. Soc. hort. Sci.*, **39,** pp. 274-8.

Lloyd George is the best parent for autumn fruiting. The results of crosses between Cuthbert and Lloyd George and the high percentage of autumn fruiting seedlings in their selfed progeny indicate that these varieties are the best to use for breeding for autumn fruiting in the N. Pacific Coast region. The ability of Lloyd George to transmit autumn fruiting to much of its progeny depends on the tendency to autumn fruiting in the other parent used. In Maryland the cross Lloyd George × Ranere has proved promising for the production of summer and autumn fruiting varieties. 'It is probable that there are at least two allelomorphs: (*a*) spring fruiting only, and (*b*) spring and fall fruiting.'

Waldo, G. F. 1941. *See* **Fischer, H. E., Darrow, G. M., and Waldo, G. F.**

935. Waldo, G. F., and Wiegand, E. H. 1942. Two new varieties of blackberry, the Pacific and the Cascade. *Sta. Circ. Ore. agric. Exp. Sta.*, **269**, 4 pp. (Mimeographed.)
Pacific, from *Rubus macropetalus* (Zielinski) × loganberry, has hermaphrodite flowers, and long, very dark red fruits resembling *R. macropetalus* in flavour although having the acidity of a loganberry. Cascade, from the same cross, resembles Pacific but is more vigorous; the fruit is softer.

936. Waldo, G. F., Wiegand, E. H., and Hartman, H. 1943. New berries from Oregon's plant breeding research. *Sta. Bull. Ore. agric. Exp. Sta.*, **416**, 11 pp. (From *Plant Breed. Abstr.*, **16**, pp. 225-6.)
In the co-operative breeding programme of small fruits in Oregon over 150,000 individual crosses have been made during the period 1921-1943. Descriptions are given of new varieties named and introduced since 1930, viz. Pacific and Cascade blackberries and Willamette red raspberry. Willamette, from Newburgh × Lloyd George, has outyielded Cuthbert and has firmer and larger fruit. In frozen pack tests it is among the best and in canning it gives the same grade as Cuthbert.

Waldo, G. F. 1947. *See* **Darrow, G. M., Williams, C. F., and Waldo, G. F.**

937. Waldo, G. F., and Darrow, G. M. 1948. Origin of the Logan and the Mammoth blackberries. *J. Hered.*, **39**, pp. 98-107.
Seedlings from crosses of 8*x* native western trailing blackberries with the 4*x* European raspberry La France, showed close resemblance to the Logan. The seedlings of a western trailing blackberry crossed with the 4*x* Eldorado resembled the Mammoth blackberry. From this it is concluded that the Logan and Mammoth did originate from the parents suggested by Judge J. H. Logan, and later by Crane and Thomas.

In all crosses of western blackberry × La France a number of very weak or dwarf plants appeared, but in one cross (Branstetter × La France) there was only one dwarf in 79 plants whereas in the other progenies the proportion ranged from 12% to almost 50%.

Californian pistillate blackberries (8*x*) crossed with La France (4*x*) produced pistillate and perfect flowered types in about equal numbers. The seedlings of the perfect flowered Oregon selection Ideal Wild × La France were all perfect flowered.

In all crosses of western blackberry × La France the fruit colour of the F_1 was deep red, similar to that of the Logan.

Data are included on fruit 'plugging'. In three of the crosses (Jenner 1, Jenner 2 and Ideal Wild × La France) from 40% to 72% of the progeny 'plugged'. The other crosses (Branstetter, Agate Beach, Point Arena, and Patrick Point × La France) showed a range from 0 to 8% of plants with free plugs.

Fruit size varied considerably as between seedlings. There was considerable difference in seediness (weight of seed in 20 berries); Branstetter × La France seedlings were the most seedy and Patrick Point × La France the least. Seed size (weight) also showed considerable variation. The

prickles of all seedlings were much like those of the Logan except that those of the Branstetter crosses were softer.

Crosses of Jenner 1 (8*x*) blackberry × Eldorado blackberry gave 1 pistillate: 1 hermaphrodite. About a quarter of the plants were dwarf. This cross gave attractive bright black berries of good flavour and there was much variation in season of ripening.

938. Waldo, G. F. 1950. Breeding blackberries. *Bull. Ore. agric. Exp. Sta.*, **475,** 38 pp.

Sources of desirable characteristics in processing berries are: high flavour —Logan and western trailing native blackberries; bright black colour— Himalaya, Black Logan, eastern upright types and western native trailing blackberries; berry size—Boysen and its seedlings.

Sterility, an important factor in blackberry breeding, showed no consistent relation to chromosome number. Sex inheritance was a factor in the use of the western native blackberries as parents. The cross pistillate × perfect-flowered gave pistillate and staminate or perfect-flowered in a 1: 1 ratio.

Leaf spot (*Mycosphaerella rubi*) resistance appeared to be obtained from the European blackberries and the Boysen. Susceptibility to leaf spot was most prevalent in seedlings from western native blackberries, Lucretia and Young. Winter hardiness was obtained from all sources.

Sib-crossing seedlings of Zielinski × Logan gave more fertility than backcrossing or selfing, though the fertility was not equal to that of the original cross.

939. Walker, E. H. 1942. Two new dwarf species of *Rubus* from western China and Tibet and their Asiatic relatives. *J. Wash, Acad. Sci.*, **32,** pp. 260-2.

Detailed descriptions are given of *Rubus yui* Walker and *R. clivicola* Walker. These belong to the subgenus *Cylactis* and a key to the Asiatic species of this subgenus is given. The species concerned are *R. pedatus* (from northern California to Alaska and Japan), *R. fockeanus* (China and India), *R. yui* (China), *R. rubisetulosum* (China and Tibet), *R. potentilloides* (Burma), and *R. clivicola* (China).

940. Watson, W. C. R. 1931. Brambles of Kent and Surrey. *London Nat.* (*1930*), pp. 68-74.

941. Watson, W. C. R. 1931. Bramble notes, 1930. *Rep. Bot. Exch. Club* (*1930*), **9,** pp. 423-37.

942. Watson, W. C. R. 1932. Some British *Rubi*, new and old. *Rep. Bot. Exch. Club* (*1931*), **9,** pp. 761-8.

943. Watson, W. C. R. 1933. Notes on *Rubi*. What is *Rubus rhombifolius* Weihe? *J. Bot., Lond.*, **71,** pp. 223-8.

944. Watson, W. C. R. 1935. Notes on *Rubi*. *J. Bot., Lond.*, **73,** pp. 252-4.

945. Watson, W. C. R. 1935. Brambles of Kent and Surrey. *London Nat.* (*1934*), pp. 59-66.

946. Watson, W. C. R. 1937. Notes on *Rubi*. *J. Bot., Lond.*, **75**, p. 201.

947. Watson, W. C. R. 1946. *Rubus*, in check-list of British Vascular Plants. *J. Ecol.*, **33**, pp. 337-44.

948. Watson, W. C. R. 1948. Weihean species of *Rubus* in Britain. *Watsonia*, **1**, pp. 71-83.

Webb, P. C. R. 1949. *See* **Pitcher, R. S.**, and **Webb, P. C. R.**

Weber, A. 1929. *See* **Jørgensen, C. A.**, and **Weber, A.**

Weber, P. V. 1944. *See* **Hildebrand, E. M.**, and **Weber, P. V.**

949. Weidler, R. C. 1932. The Youngberry. *Bull. Fla agric. Exp. Sta.*, **57**, 9 pp.
The Youngberry originated from a cross between loganberry and Austin dewberry.

950. Weihe, K. E. A., and **Nees von Esenbeck, C. G. 1822-7.** *Rubi germanici descripti et figuris illustrati.* Elberfeld.

951. Wenzl, H. 1950. (A new red mildew resistant gooseberry variety.) *PflSchBer.*, **5**, pp. 106-9. (From *Plant Breed. Abstr.*, **21**, p. 184.)
This new red gooseberry variety Mehltaufeste Höfleiner found at Höflein, Austria, is highly resistant to American mildew. The fruits, 6-9 cm. long, grow singly on the bush, which has many thorns. The origin of the seedling is unknown.

952. Wellington, R. 1913. Raspberry breeding. *Proc. Amer. Soc. hort. Sci.*, **10**, pp. 155-9.

953. Wellington, R., Hatton, R. G., and **Amos, J. 1921.** The 'running off' of black currants. *J. Pomol.*, **2**, pp. 160-98.
This paper includes a detailed survey of fertilization and pollination in black currants. The four main groups, Boskoop Giant, French, Baldwin, and Goliath, all proved capable of self-fertilization and all proved completely cross-fertile. It is probable that some flowers are self-pollinated before they open.

The total flowering period of a raceme lasts about 3 weeks and usually the basal flower opens first. The open period of individual flowers lasts 5-7 days, the stigma being receptive for 5 or 6 days. When still in the bud and for 24-48 hours after the flower opens the stigma is green and has a sticky, almost watery, receptive surface. This gradually becomes dull, then again becomes watery, before the final browning and drying off. Pollination was equally effective at all stages including that of the brownish style. The pollen is sticky, so that wind can play no part in pollination. The main work of pollination is carried out by bees and their activities are largely regulated by weather.

Two types of flower formation occur in black currants, (*a*) those with the style shorter than the stamens so that the stigma is just below the anthers, and (*b*) with styles longer than the stamens, bringing the stigma above and out of reach of the anthers. The Baldwin group has 99% of its flowers with the stigmas and anthers more or less level, Boskoop Giant

shows 57% of this type and 42% with the stigma raised right above the stamens. In French and Goliath these percentages are 48: 50 and 79: 20 respectively. All groups showed 1-2% of flowers with the style shorter than the stamens. In all groups the style was shortest in the basal flower of the raceme.

It is concluded that running-off is caused by inefficient pollination.

954. White, D. G., and **Kennard, W. C. 1950.** A preliminary report on the use of maleic hydrazide to delay blossoming of fruits. *Proc. Amer. Soc. hort. Sci.*, **55,** pp. 147-51.

Blossoming of black raspberry was delayed 24-38 days and maturity of fruit was delayed 16-23 days by spraying with maleic hydrazide at dilutions of 1,000-3,000 p.p.m. No injury was apparent on plants treated with the lower concentrations.

White, F. H. 1950. *See* **Hunter, A. W. S.,** and **White, F. H.**

955. Wickson, E. J. 1894. The Logan Berry. *Rep. Calif. agric. Exp. Sta. 1893-4*, p. 340.

The loganberry, a cross of the Aughinbaugh blackberry and an unnamed raspberry, was released in 1893.

The originator, J. H. Logan, states that the loganberry comes true from seed, although not all the seedlings are as good as their parent.

Wiegand, E. H. 1942. *See* **Waldo, G. F.,** and **Wiegand, E. H.**

Wiegand, E. H. 1943. *See* **Waldo, G. F., Wiegand, E. H.,** and **Hartman, H.**

956. Wiggans, C. C., and **Baker, R. E. 1943.** Seeking larger raspberries. (Reported by **W. W. Burr.**) *Rep. Neb. agric. Exp. Sta.*, **56,** p. 37.

One hundred shoots of Cumberland and Latham were treated with colchicine-lanolin emulsion (0·1 and 0·5%), the emulsion being applied to the terminal bud when the shoots were 2-3 in. tall. The higher concentration was invariably lethal. The 0·1% concentration was ineffective on Cumberland but caused changes in 12 shoots of Latham giving thicker leaves of a different shade of green. All efforts to root these altered stems failed.

957. Wiggans, C. C. 1944. Fruit breeding. *Rep. Neb. agric. Exp. Sta.*, **57,** pp. 41-2.

Flowers on colchicine treated Latham canes were self-pollinated and those on four canes developed fruit with apparently normal seed.

958. Wiggans, C. C. 1945. Fruit breeding. *Rep. Neb. agric. Exp. Sta.*, **58,** p. 43.

The selfed seed from colchicine treated Latham canes germinated but the plants died when planted out.

959. Wilhelm, S., Thomas, H. E., and **Jensen, D. D. 1948.** A dwarfing virus disease of bramble fruits. *Phytopathology*, **38,** p. 919 (Abstr.).

A graft transmissible disease of bramble, serious in California mainly on Logan, is proved to be a virus. The symptoms are dwarfing of cane, weak development of fruiting laterals, downward cupping and yellow-bronze

colouring of leaves, premature reddening in the fall and precocious development of basal buds. Logan, Mammoth, Cory's Thornless, Phenomenal and the Pacific Coast trailing blackberry (*Rubus ursinus*) are readily graft inoculated and all but the last affected severely. Boysen, Young and Nectar show less severe symptoms and preliminary tests with raspberry indicate that it may act as a symptomless carrier.

960. Wilhelm, S., and **Thomas, H. E. 1950.** *Verticillium* wilt of bramble fruits with special reference to *Rubus ursinus* derivatives. *Phytopathology*, **40,** pp. 1103-10.
Verticillium wilt (*V. albo-atrum*) is one of the most destructive diseases of brambles in California. Logan, Mammoth and Cory Thornless are highly tolerant or immune; Boysen, Nectar and Young are susceptible but their seedlings segregate for susceptibility and resistance. Logan breeds true for resistance. *R. procerus*, *R. laciniatus*, *R. ulmifolius* var. *inermis* and probably *R. procumbens* are tolerant or immune. Small F_1s of Logan × Lloyd George (susceptible) and Boysen × Himalaya (*R. procerus*) were resistant.

961. Wilhelm, S., Thomas, H. E., and **Koch, E. C. 1951.** Diseases of the loganberry. *Calif. Agric.*, **5** (1), pp. 11, 14.
Immune from *Verticillium* wilt and from powdery mildew (*Sphaerotheca humuli*), loganberries sustain heavy damage in California from dwarf virus, the thorny varieties being chiefly affected.

962. Wilhelm, S., and **Thomas, H. E. 1954.** Blackberries resistant to wilt. *Calif. Agric.*, **8** (1), pp. 8, 12. (From *Plant Breed. Abstr.*, **24,** p. 627.)
The varieties Burbank Thornless, Chehalem, Himalaya, Merton Thornless, Oregon Evergreen, Logan, Black Logan, Cascade, Mammoth, Ollalie, and Phenomenal, which are resistant to *Verticillium* wilt, are described briefly. A diagram showing the parentage of the last six varieties and also of Young and Cuthbert is given.

963. Williams, C. F. 1938. The Dixie red raspberry. *Ext. Circ. N.C. agric. Exp. Sta.*, **227,** 7 pp.
Dixie, from *Rubus biflorus* × Latham, is vigorous, drought resistant, high yielding, and resistant to most raspberry diseases.

964. Williams, C. F., and **Darrow, G. M. 1940.** The trailing raspberry—*Rubus parvifolius* L. Characteristics and breeding. *Tech. Bull. N.C. agric. Exp. Sta.*, **65,** 13 pp.
R. parvifolius of Japan and Korea is described: most selections from it are self sterile, but a few F_2 plants have been obtained. *R. parvifolius* is resistant to most raspberry diseases. Crosses between it and red raspberry show much sterility. Some of the hybrids were leaf spot immune, others were susceptible; high resistance and high susceptibility to rust also occurred.

965. Williams, C. F. 1945. Breeding raspberries for North Carolina. *Prog. Rep. Res. and Fmg, N.C.* **3** (2), pp. 9, 12.
Rubus kuntzeanus, *R. biflorus*, *R. coreanus*, *R. parvifolius*, and *R. glaucus* have been crossed with American raspberry varieties and promising hybrids have been obtained. Among these hybrids is Dixie, released in 1938.

Williams, C. F. 1947. *See* **Darrow, G. M., Williams, C. F.,** and **Waldo, G. F.**

966. Williams, C. F., Smith, B. W., and **Darrow, G. M. 1949.** A Pan-American blackberry hybrid. Hybrids between the Andean blackberry and American varieties. *J. Hered.*, **40,** pp. 261-5.

The Andean blackberry (*R. glaucus* 2n=28) is very resistant to anthracnose and leaf spot. F_1 hybrids between *R. glaucus* and black and red raspberry were 3*x* and sterile. Of two partially fertile hybrids of *R. glaucus* × Youngberry one was 5*x*, and the other aneuploid (2n=37). They resembled the parent contributing the greater number of chromosomes, thus the triploids with one raspberry and two *R. glaucus* genomes exhibited the disease resistance of *R. glaucus*. The dominance of disease resistance in the 3*x* hybrids suggests that it would be desirable to obtain fertility by doubling the chromosomes of the hybrids rather than by developing tetraploid plants of the American parents before crossing. Colchicine treatments have so far failed.

Most hybrids of 2*x* American raspberries with the 2*x* species *R. parvifolius*, *R. biflorus*, *R. coreanus*, and *R. kuntzeanus* have been at least partially fertile, and several have been fully self fertile. All hybrids between the 2*x* American black raspberry and these same species have been completely sterile.

967. Williams, C. F. 1950. Influence of parentage in species hybridization of raspberries. *Proc. Amer. Soc. hort. Sci.*, **56,** pp. 149-56, and *Proc. 47th annu. Convent. Ass. S. Agric. Wkrs, Biloxi, Miss.*, p. 112.

Of about 40 introduced *Rubus* species eight have been successfully crossed with American red raspberries. Backcrossing of the F_1s to American varieties has been successful through 2 or 3 generations with four species: *R. biflorus*, *R. coreanus*, *R. parvifolius*, and *R. kuntzeanus*.

Crosses of *R. biflorus* × Cuthbert and Taylor showed marked resistance to *Septoria rubi* (from *R. biflorus*) as did hybrids of *R. coreanus*. F_1s of *R. kuntzeanus* × American showed segregation for resistance and susceptibility. The highest resistance of all was shown by F_1s of *R. parvifolius* × American.

In the first backcross progenies of *biflorus* as donor parent, the hybrid selection used as parent had more influence on the vigour of the progeny than did the American parent. Probably both parents influence fruit size. A high degree of fertility was recovered in the backcross progenies.

R. biflorus is resistant to late rust and its hybrids were not seriously affected. *R. parvifolius* has very large fruit and this character is transmitted to its hybrids. *R. kuntzeanus* has small fruit and this character, also, is transmitted to its hybrids.

968. Wilson, J. 1900. The structure of certain new hybrids (*Passiflora*, *Albuca*, *Ribes*, *Begonia*). *J. roy. hort. Soc.*, **24,** pp. 146-80.

A detailed description is given of three hybrids of *Ribes nigrum* × *R. grossularia*, named by the author *R. nigro-grossularia*. The three F_1 plants obtained were spineless, lacked the sessile glands and the characteristic odour of the black currant, and usually had three or four flowers per inflorescence. The hybrids flowered at about the same time as the black currant, producing little or no normal pollen. No fruit was set.

Black currant-gooseberry hybrids supplied by Burnett and by Culverwell, probably with different varieties as parents, were similar to the three described above, except that one of Culverwell's plants set seedless fruit.

969. Winter, J. D. 1925. Use of plant characters in identification of red raspberry varieties. *Proc. Amer. Soc. hort. Sci.*, **22,** pp. 261-4.
A key is given to the identification of red raspberry varieties grown in Minnesota.

970. Winter, J. D. 1929. A preliminary account of the raspberry aphids. *Tech. Bull. Minn. agric. Exp. Sta.*, **61,** 30 pp.
The biology and morphology of *Amphorophora rubi* (Kalt.), *A. rubicola* (Oestlund) and *Aphis rubicola* (Oestlund) are dealt with.

Counts of *Amphorophora rubi* on 100 random leaves from each of a range of varieties were made on various dates at Howard Lake and Lake City. These counts added together give total aphids on 600 leaves per variety. Expressed as aphids per 100 leaves the figures are: King 78·0, Latham 66·7, St. Regis 66·5, Sunbeam 43·7, Golden Queen 18·7, Cuthbert 18·0, and Herbert 0·3. Eighteen adult *A. rubi* put on Herbert yielded a total population of 73 in 16 days whereas similar numbers put on King and Latham yielded respectively 287 and 191 at the end of the same period. Where King and Latham plants were not included in the same cage as Herbert, however, the population on Herbert decreased. This was shown by removing the other two varieties at the time when the total population on Herbert was 73; after 35 days only 15 aphids remained. In another experiment 20 adults were put on Herbert and 20 on Latham. Sixteen days later there were no individuals on Herbert while Latham had 52 adults and nymphs. Further experiments also supported the conclusion that Herbert is resistant.

A study of the time taken for *A. rubi* individuals, to assume the normal feeding position with the proboscis fully inserted was made for both Herbert and Latham. There was no difference in the average time taken, indicating that resistance was unlikely to be a matter of resistance to penetration.

The following aphids have been recorded on *Rubus*:

R. idaeus: Amphorophora rubi, *Aphis idaei*, *Macrosiphum poae*, *M. rubiellum*, and *M. rubifolium* (all European records).

R. occidentalis: Amph. rubi, *Amph. rubicola*, *Amph. sensoriata*, *Aphis rubicola*, *Cerosipha rubifolii*, *Pemphigus rubi* (all American records).

R. parviflorus: Amph. davidsoni, *Amph. rubi*, *Amph. rubicola* (all N. American records).

R. saxatilis: Amph. rubi (Europe).

R. strigosus: Amph. rubi, *Amph. rubicola*, *Amph. sensoriata*, and *Aphis rubicola* (all N. American records).

Red Raspberry, American cultivated: *Amph. rubi*, *Amph. rubicola*, *Amph. sensoriata*, and *Aphis rubicola* (all N. American records).

Salmonberry (probably *R. spectabilis* or *R. parviflorus*): *Amph. maxim* (N. America).

R. fruticosus: Amphorophora rubi, *M. rubiellum*, *M. rubifolium* (all European records).

Blackberry, American native: *Amph. rubi*, *C. rubifolii* (both N. America).

Blackberry, American cultivated: *Amph. rubi*, *C. rubifolii* (both N. America).

R. caesius: Amph. rubi (Europe).

971. Winter, J. D. 1930. Identification of cultivated raspberries. *Tech. Bull. Minn. agric. Exp. Sta.*, **66,** 14 pp. (From *Exp. Sta. Rec.*, **64,** p. 140.)
The botany of the cultivated raspberry and the characters used in distinguishing species and varieties are discussed, and a key is presented to 16 horticultural varieties. The most useful characters in varietal identification were the presence or absence of glands on the petiole, peduncle, pedicel and calyx, whether these glands were stalked or sessile, the form of leaflets on young canes, the bristles on the young cane, petiole, peduncle, pedicel and calyx, particularly the quantity of bristles on the petiole and the colour at their base, and finally fruit characters.

972. Winter, J. D. 1940. Strawberry and raspberry varieties for freezing storage. *Proc. Amer. Soc. hort. Sci.*, **37,** pp. 579-82.
Chief, Latham, and Viking were the most satisfactory of 10 red raspberry varieties for dessert after 6-10 months' storage at *c.* −10° F.

973. Wood, C. A. 1949. Raspberry cane nurseries. *Rep. E. Malling Res. Sta. for 1948*, pp. 141-7.

974. Wood, C. A. 1950. Promise canes slow to recover (from frost). *Fruitgrower*, p. 165.
Severe wind frosts in late April seriously damaged leaves and flower buds of Promise. This induced growth from buds lower down the stem and a few secondary laterals. St. Walfried flower buds showed more severe damage but more secondary laterals were formed promoting partial recovery from frost. Lloyd George also suffered more extensive frosting of flower buds than Promise, but formed abundant secondary laterals permitting a good recovery. Newburgh and Norfolk Giant, being late, showed much less damage.

975. Wood, C. A. 1950. Variety trials—raspberries in Scotland. *Fruitgrower*, p. 846.

Wood, C. A. 1951. *See* **Cadman, C. H.,** and **Wood, C. A.**

976. Wood, C. A., and **Boase, M. 1951.** Fruit variety trials. I. A trial of ten varieties of raspberry at Forfar, Angus. *Scot. Agric.*, **31,** pp. 159-67.
Yields over the first four seasons are given, and notes are included on the fruit quality, season of ripening, reaction to spring frosts, and processing quality of the varieties. Norfolk Giant, Jewel and Lloyd George are good for canning; Burnetholm, Enterprise and Notable are fairly good; St. Walfried, Newburgh, Landmark, Promise, Exploit, and Malling M are poor. For quick freezing St. Walfried, Newburgh, Promise, and Landmark are poor, the other varieties are satisfactory.

977. Wood, C. A. 1952. Raspberry varieties in Great Britain. *Rep. E. Malling Res. Sta. for 1951*, pp. 82-92.
Characters desirable in modern raspberry varieties are: high yield, fairly erect habit, compact stools, adequate but not excessive cane production, smooth canes, strongly attached fruiting laterals, conspicuous fruit easy to plug, frost and disease and pest resistance, suitability for both processing and dessert.

Eleven varieties of commercial importance are described in detail:

Burnetholm Seedling, grown mainly in the Clyde Valley, crops moderately but has good quality firm fruit satisfactory for dessert, canning, and probably for quick freezing.

Lloyd George, when healthy, crops heavily. Although seriously susceptible to spring frost injury, it recovers well by forming late-fruiting secondary laterals. The early ripening fruit is suitable for canning, freezing and dessert.

Enterprise, from Preussen crossed with a seedling derived from Lloyd George and Pyne's Royal, has superior fruit quality, but often produces too few canes. It is deep rooting, drought resistant, and an excellent garden variety. The fruit is fairly suitable for canning and freezing, but tends to darken when canned. It is tolerant to certain viruses but susceptible to raspberry cane midge, *Thomasiniana theobaldi* Barnes.

Exploit, from Newburgh crossed with a seedling derived from Lloyd George and Pyne's Royal, resembles Promise but has proved the better in yield, fruit size, colour and dessert quality; not suitable for canning but much better than Promise for freezing.

Jewel, from the same family as Enterprise, is virus tolerant and crops regularly and heavily; the canes are erect and almost smooth. Although it flowers a little later than Lloyd George, and is thus less liable to frost damage, it ripens early and the good quality fruit is easily picked and is very suitable for canning and acceptable for freezing.

Landmark, from Preussen · Baumforth A, bears outstandingly heavy crops, but the fruit is very soft, often difficult to plug, apt to spoil in a wet season, and acid. Generally suitable only for jam. The canes are thorny and highly susceptible to cane spot.

Notable, from a cross between Preussen and Lloyd George, yields only an average crop; suitable for dessert, but only moderate for canning and freezing.

Promise, a cross of Newburgh with a seedling derived from Lloyd George and Pyne's Royal, is outstandingly early and high yielding and seems resistant to spring radiation frosts though it may be severely affected by late air frosts. Though suitable for jam, it is not generally satisfactory for canning and freezing, and may be too soft for dessert.

Newburgh, a cross between the American varieties Newman and Herbert, is virus tolerant but has proved highly susceptible to damage by the raspberry cane midge and associated fungal infections in southern districts. Though too crumbly for canning and freezing, the fruit is suitable for dessert and jam.

Norfolk Giant, a chance seedling from Norfolk, is an average to fairly heavy cropper. By flowering late it often escapes spring frost damage. It ripens late and is favoured for canning, freezing, and jam. New canes are spreading in habit. Subject to cane spot and expressive of nearly all the known viruses.

St. Walfried, from Lloyd George · Hornet (almost certainly the Hornet A of Grubb, 1922), is often a high yielder but may be slow to become established. It is seriously susceptible to spring frost injury. The fruit, not always easy to plug when fully ripe, is grown mainly for jam.

Notes are provided on the following varieties classed as being of minor commercial importance: Bath's Perfection (syn. Marlboro, Laxton's Abundance), Baumforth A, Baumforth B, Carter's Bountiful (possibly derived from Superlative), Chartham, Devon, Hercules, Hornet, Laxton's Bountiful, Matchless, Malling G, Malling K, Malling M, Norwich

Market, Norwich Wonder, Preussen, Pyne's Imperial, Pyne's Royal, Park Lane, Red Cross.

Rubus occidentalis is difficult to establish in Britain due to susceptibility to *Verticillium* wilt.

978. Wood, C. A. 1954. Raspberry variety trials and cultural experiments. *Bull. Edinb. Coll. Agric.*, **47,** pp. 17-23.

Wood, C. A. 1954. *See* **Grubb, N. H.,** and **Wood, C. A.**

979. Wood, C. A. 1954-5. Fruit variety trials. II. A trial of raspberry varieties and seedlings at Kirriemuir, Angus. *Scot. Agric.*, **34,** No. 3, pp. 1-5.

The trial included Exploit, Promise, Lloyd George (N.Z.) and Malling seedlings V, W, Y, Z. Exploit and N.Z. Lloyd George both outyielded Promise in average crop over the period 1950-54 and V had the lowest average yield. V, however, showed some resistance to grey mould and less loss of crop than Promise and Exploit in 1953—a bad mould year.

The author concludes that in planting for the jam market the choice of early varieties lies between Promise, Exploit and Lloyd George; for canning, quick freezing and fresh fruit, Lloyd George or other firm fleshed varieties are preferable to Promise and Exploit.

980. Woodroof, J. G. 1929. The Young dewberry. *Circ. Ga agric. Exp. Sta.*, **86,** 6 pp.

The Young dewberry, from Austin × Phenomenal, is a vigorous, hardy and productive plant propagated by tips. The canes are very spiny. The fruit ripens late May to late June in Georgia and is large ($\frac{3}{4}$-$1\frac{1}{4}$ in. long), glossy, dark red, moderately easy to pick but susceptible to bruising, and highly flavoured. It is suitable for dessert, canning, jam, juice and short distance shipments.

Wormald, H. 1921. *See* **Salmon, E. S.,** and **Wormald, H.**

981. Wormald, H. 1928. Notes on plant diseases in 1926. *Rep. E. Malling Res. Sta. for 1926 and 1927. II. Supplement*, pp. 75-88.

Careless and Freedom were seriously affected by gooseberry leaf spot (*Pseudopeziza ribis*); Whitesmith, White Lion, Greengage and Gunner were less severely affected.

982. Wormald, H. 1928. Notes on plant diseases in 1927. *Rep. E. Malling Res. Sta. for 1926 and 1927. II. Supplement*, pp. 111-18.

A severe attack of *Pseudopeziza ribis* is recorded on Baldwin black currant, but other varieties [unspecified] growing alongside were not attacked.

Reader's Perfection raspberry appears particularly susceptible to spur blight (*Didymella applanata*).

983. Wormald, H. 1955. Diseases of fruits and hops. Crosby Lockwood & Son Ltd., London, 3rd edn., 325 pp.

984. Yarnell, S. H. 1932. Chromosome behaviour as a factor in berry breeding. *Proc. Amer. Soc. hort. Sci.*, **28,** pp. 114-17.

The Nessberry arose from a group of more or less sterile hybrids made in 1912 between the wild dewberry (*Rubus rubrisetus*, 2n = 14) and the Brilliant

red raspberry (*R. idaeus* var. *strigosus*, 2n=14). Open-pollinated seed from these hybrids gave some fertile plants in which the chromosome numbers had doubled, and eight of these were collectively called Nessberry. Nessberry × Hailsham [the latter is regarded by the author as diploid] was examined cytologically in F_3; 24 plants were $4x$ and two were $2x$. About half of the 162 plants of this F_3 were completely fertile. Nessberry × Early Harvest blackberry (*R. laudatus*) gave a $3x$ F_1 and even in F_4 there was less fertility than in the cross with Hailsham. This is considered to be due to the blackberry chromosomes being less closely related to those of the Nessberry. Seven plants were examined in the F_4 and all were $4x$. The backcross Nessberry × dewberry gave poor germination in F_2; only three F_2 plants out of 39 were completely fertile. Four plants examined cytologically were all $2x$. The cross Nessberry × Brighton red raspberry gave eight F_2 plants. The only plant examined was $4x$ and three of the eight showed full fertility.

985. Yarnell, S. H. 1936. Chromosome behaviour in blackberry-raspberry hybrids. *J.agric. Res.*, **52,** pp. 385-96.

A cytological study is given of hybrids between the Nessberry and dewberry, raspberry and blackberry. The Nessberry is an amphidiploid (n=14) of *Rubus rubrisetus* (=*trivialis*) and *R. strigosus* origin. The dewberry cross was a first backcross to *rubrisetus*. The raspberry crosses were made with Brighton and Hailsham, both *R. idaeus* [Hailsham is apparently regarded as diploid by the author]. The blackberry crosses were to Early Harvest, *R. argutus*. In the F_2 of the backcross to dewberry, diploids, triploids, and tetraploids were observed. The triploids were of two types—one plant favouring the Nessberry and three plants nearer to the wild dewberry but more vigorous. Seven bivalents plus 7 univalents were found during the first division of the first triploid; from 3 to 4 trivalents (sometimes more) can be distinguished in the second type.

Plants of the F_3 of Nessberry × Hailsham and of the F_4 of Nessberry × Early Harvest blackberry were all tetraploid, possibly owing to selection of plants resembling the Nessberry in earlier generations. Meiosis of these plants is distinguished from that of the Nessberry by the frequent occurrence of multivalents giving from one to seven quadrivalents, and by considerable chromosome irregularity during the reduction division.

986. Yarnell, S. H., and **Morris, H. F. 1939.** Berry breeding. *Rep. Tex. agric. Exp. Sta.*, **52,** p. 22.

Superior seedlings of the backcross of Nessberry to dewberry and raspberry have been selected. In the backcross to the dewberry, the type of fruit and growth-habit of the dewberry are dominant. In the backcross to the raspberry, the plants resemble the Nessberry rather closely. Both sets of hybrids vary greatly in flavour.

987. Yarnell, S. H., and **Blackhurst, H. T. 1942.** The use of a mist spray in rooting *Rubus* single-bud stem cuttings. *Proc. Ass. S. agric. Wkrs*, **43,** p. 175.

988. Yarnell, S. H., and **Blackhurst, H. T. 1947.** A polyploid chromosome series from a cross of the Lawton blackberry and the Nessberry. *Proc. Amer. Soc. hort. Sci.*, **49,** pp. 189-92.

The Nessberry (n=14) found by Ness in 1917 in a segregating F_2 of *Rubus rubrisetus* × Brilliant red raspberry, is an amphidiploid. Nessberry ♂

× Lawton ♀ blackberry (2n=28) gave 24 plants; the reciprocal gave 1 tetraploid plant. Of the 24 plants mentioned, 4 were small with 2n=14 chromosomes, 4 vigorous triploids, 11 tetraploids similar in appearance to Lawton, 4 tetraploids obviously hybrid, and a single obviously hybrid plant with 35 chromosomes. It is suggested that the 2*x* plants developed from a reduced egg without fertilization. Their similarity suggests that Lawton is an autotetraploid. The triploids presumably arose from the union of a 2*x* egg of Lawton with a 7-chromosome Nessberry pollen grain. They resemble Lawton. Such 7-chromosome pollen grains presumably carry a basic set of chromosomes either of raspberry or dewberry. The single 5*x* plant presumably arose from the union of a 2*x* Lawton egg with a 3*x* Nessberry pollen grain.

989. Yeager, A. F., and **Latzke, E. 1933.** Gooseberries, varieties, breeding, culture and use. *Bull. N. Dak. agric. Exp. Sta.*, **267,** 19 pp. (Condensed from *Plant Breed. Abstr.*, **4,** p. 86.)

A short historical introduction on gooseberry varieties in America is followed by a description of crosses begun in 1920, between the native wild gooseberry *Ribes missouriense* and several American cultivated varieties. Of these crosses, one, Oregon Champion × *R. missouriense*, yielded plants that were nearly all strong, vigorous, hardy and fruitful and so superior that 14 selected seedlings were tested under propagation in 1932, and the following three subsequently named and distributed to growers: Pixwell (N.D. No. 9), Abundance (N.D. No. 7), Perry (N.D. No. 3). All were remarkable for productivity, especially Abundance. Four hundred seedlings have been raised from these varieties, and breeding and selection are in progress. An attempt was made to obtain greater drought resistance from the cross Oregon Champion × *R. setosum* but the progeny were of no value.

Red fruit proved dominant to green, smooth fruit to downy, long pedicel and peduncle to short (apparently due to more than one factor). Oregon Champion appeared heterozygous for the dominant factor for dwarf habit and for a dominant factor for light green unripe fruit as compared with the dark green of the American wild gooseberry.

990. Yeager, A. F. 1938. Pollination studies with North Dakota fruits. *Proc. Amer. Soc. hort. Sci.*, **35,** pp. 12-13.

Pixwell and Abundance gooseberries proved self-fruitful but Perry failed to set fruit when selfed.

Ribes aureum produced few and inferior fruits when selfed or when pollinated by sister plants, but when cross pollinated with unrelated plants of the same species it gave large attractive fruits.

Fleming currant, *R. americanum*, gave no selfed fruit in 1936, while in 1937 fairly normal sets were noted in some cases.

991. Yeager, A. F., Latimer, L. P., and **Eggert, R. 1945.** Agricultural Research in New Hampshire. *Bull. N.H. agric. Exp. Sta.*, **363,** 61 pp.

On p. 37 it is noted that hybrids between blackberry and *Rubus odoratus* flowered in 1944. They are nearly sterile, thornless plants with pink flowers. Root cuttings, treated with colchicine, gave several apparently 4*x* plants.

992. Yeager, A. F., and **Richards, M. C. 1948.** A new fall bearing red raspberry, Durham—and the spur blight problem. *Proc. Amer. Soc. hort. Sci.*, **52,** pp. 263-4.
Viking proved less susceptible to spur blight (*Didymella applanata*) than Taylor and Latham. Durham was bred to escape the effects of spur blight in the spring and gives a good autumn crop. It arose from Taylor × Nectarberry but 'it is not thought that the Nectarberry actually entered into the genetic constitution of this plant since there are no indications of it.'

993. Yeager, A. F. 1949. New development in raspberries. *Fruit Var. hort. Dig.*, **4,** pp. 4-6.
The breeding of raspberries suitable for a cold climate is described.

994. Yeager, A. F. 1950. Breeding improved horticultural plants. II. Fruits, nuts and ornamentals. *Bull. N.H. agric. Exp. Sta.*, **383,** 16 pp.
Durham, probably a parthenogenetic seedling of the raspberry Taylor, produces a larger autumn crop than any other variety tested at the Station. Crosses have been made between Taylor and *Rubus odoratus* and between the blackberry Snyder and *R. odoratus* so as to incorporate the thornlessness and disease resistance of *R. odoratus* in new high yielding varieties. Promising hardy F_2 and F_3 selections of crosses between Taylor ($2n=14$) and the bake apple berry ($2n=56$) have been produced.

995. Yeager, A. F., and **Meader, E. M. 1954.** Many interspecific *Rubus* hybrids. *Bull. N.H. agric. Exp. Sta.*, **409,** p. 25.
The following species have been crossed with raspberry and blackberry varieties: *Rubus pungens*, *R. morifolius*, *R. chamaemorus*, *R. odoratus*, *R. pubescens*, *R. arcticus*, and *R. canadensis*.

996. Zabel, H. 1904. (Small dendrological contribution.) *Mitt. dtsch. dendrol. Ges.*, **13.** (Reported by Nilsson, F., 1955.)
The origin of *Ribes schneideri* Maurer is given as black currant × gooseberry, made by Maurer.

997. Zacharias, E. 1911. (Partial barrenness in Lübeck currants.) *Jb. hamburg wiss. Anst.*, **29** (3), pp. 129-49. (Condensed from *Exp. Sta. Rec.*, **31,** p. 225.)
Reports work, carried forward after the author's death in 1911 by W. Himmelbaur, on the capacity as pollinators of several varieties of *Ribes pallidum*. Detailed results are given. Good fertility was obtained by crossing Lübeck with Afsmiter. The normally low fertility of the latter is ascribed to faulty pollen.

998. Zeller, S. M. 1923. Mosaic and other systemic diseases of brambles in Oregon. *Circ. Ore. agric. Exp. Sta.*, **49,** 15 pp.
Mosaic occurs on blackberries, red, purple and black raspberries, loganberries, *Rubus parviflorus*, *R. phoenicolasius*, *R. laciniatus*, and *R. macropetalus*. A list of susceptible blackberries and raspberries is given. Leaf curl is confined almost exclusively to red raspberries. Bramble streak (eastern blue stem) is confined to black raspberries.

999. Zeller, S. M. 1925. A case of *Verticillium* wilt (blue stem) of black raspberry in Oregon. *Phytopathology*, **15,** pp. 125-6.
One acre of 3-year-old Plum Farmer raspberries (*R. occidentalis*) on land used for potatoes the previous year showed 52% of dead or dying plants. The Munger variety on similar soil not previously cropped with potatoes, was still doing well after 5 years. Cultures of *V. albo-atrum* were obtained from 49 out of 51 diseased Plum Farmer plants.

1000. Zeller, S. M. 1927. Dwarf of blackberries. *Phytopathology*, **17,** pp. 629-48.
Dwarf virus disease, transmitted by *Capitophorus tetrarhodus*, spreads much more rapidly in Phenomenal berry than in the loganberry.

1001. Zeller, S. M. 1930. Yellow rust and cane blight of red raspberry in Oregon. *Bett. Fruit*, **24** (7), pp. 5-6.
Cane blight (*Leptosphaeria coniothyrium*) is the chief of the secondary infections which follow yellow rust (*Phragmidium imitans*) on raspberries in Oregon. Cumberland and Cuthbert are particularly subject to cane blight but all the important raspberry varieties are attacked.

1002. Zeller, S. M., and **Lund, W. T. 1934.** Yellow rust of *Rubus*. *Phytopathology*, **24,** pp. 257-65. (Condensed from *Exp. Sta. Rec.*, **71,** p. 661.)
All blackberries tested, *Rubus parviflorus*, *R. spectabilis*, and Munger and Plum Farmer (*R. occidentalis*) proved immune to *Phragmidium rubi-idaei* (*P. imitans*). Among the red raspberries tested, Chief and Latham were resistant, Lloyd George was tolerant, Antwerp, Owasco and Seneca were fairly resistant, while Marlboro, Cuthbert, Golden Queen, Herbert, Cayuga and Ranere were susceptible in the order named.

1003. Zeller, S. M. 1936. *Verticillium* wilt on cane fruits. *Sta. Bull. Ore. agric. Exp. Sta.*, **344,** 25 pp. (Condensed from *Hort. Abstr.*, **7,** p. 32.)
All black and purple raspberries tested were susceptible to *V. albo-atrum* although some lived for several years after being infected. Among red raspberries Cuthbert proved very resistant, but Ranere, Chief, Herbert, Red Antwerp, Latham, and Sunbeam showed considerable susceptibility. Lloyd George is highly susceptible. Among blackberries, Cory Thornless, Kittatinny, Logan, Lucretia, Mammoth, Phenomenal, Snyder, and Stuart showed some infection, whereas Evergreen, Himalaya, Lawton, and wild northwestern trailing blackberry (*R. macropetalus*) proved highly resistant.

1004. Zeller, S. M., and **Braun, A. J. 1943.** Stamen blight of blackberries. *Phytopathology*, **33,** pp. 136-43.
Susceptible commercial varieties are Boysen, Young, and Evergreen blackberry.

1005. Zielinski, Q. B., and **Galey, D. O. 1951.** Chromosome numbers of certain trailing blackberry clones. *Proc. Amer. Soc. hort. Sci.*, **57,** pp. 163-4.
The following somatic numbers are given: Black Logan 42; Branstetter 1 56; Jenner 1 56; *R. macropetalus* (Oregon selection) 84; Oregon 266 (Himalaya × Eldorado) 28; Oregon 466 (Logan 6*x* × Lucretia 6*x*) 42; Olallie (Oregon 609) (Black Logan 6*x* × Young 6*x*) 42; Oregon 616

(Zielinski $12x \times$ Logan $6x$) 63; Oregon 742 (Pacific $9x \times$ Boysen $6x$) $59 = 8x + 3$; Oregon 743 (Pacific $9x \times$ Boysen $6x$) $59 = 8x + 3$; Oregon 789 (Oregon 605 $12x \times$ Boysen) $59 = 8x + 3$; Oregon 893 (Oregon 605 $\times$ Boysen) $55 = 8x - 1$; Oregon 830 (Cascade $9x \times$ Boysen) $59 - 8x + 3$; Oregon 863 (*R. macropetalus* 12x $\times$ Arcata $6x$) $73 = 10x + 3$.

1006. Zielinski, Q. B. 1953. Chromosome numbers and meiotic studies in *Ribes*. *Bot. Gaz.*, **114,** pp. 265-74.

The chromosome number of 60 *Ribes* species mostly from western N. America including recounts of 10 species previously reported, was found to be $2n = 16$. Meiotic chromosome studies were made on *R. bracteosum*, *R. cereum*, *R. divaricatum*, *R. klamathense*, *R. menziesii*, *R. niveum*, *R. velutinum*, *R. sanguineum*, and *R. viscosissimum*. Meiotic chromosome behaviour was very similar in all species investigated and is described in detail.

Variation in chromosome size cannot be given great significance because of the very small size of *Ribes* chromosomes, and the author supports the view of Meurman (1928) that variation in fixatives explained the divergent viewpoints of Darlington and Tischler. He also agrees with Meurman that the somatic chromosomes cannot be classified in detail. Differentiation in *Ribes* appears to have been principally by genetic divergence, since the chromosome complements of all species appear so similar. This is shown by comparison of somatic chromosomes, and by the regular pairing of chromosomes at meiosis in species and in the more or less fertile interspecific hybrids.

Studies of mitosis and meiosis showed no evidence of polyploidy or aneuploidy. In every case examined only two chromosomes with satellites were noted and there was no evidence of secondary pairing. This is considered to show that Vaarama's hypothesis of a basic number of 4 chromosomes is untenable as was earlier deduced by Darlington.

1007. Zinno, T. 1953. (On the relation between the distribution of polyploidy in *Rubus* and light requirements.) *Shokubutsugaku Zasshi* (Bot. Mag., Tokyo), **66,** pp. 222-6. (From *Plant Breed. Abstr.*, **27,** p. 563.)

An inverse relation was discovered between the degree of illumination in natural habitats in Ehime prefecture and the level of polyploidy in the series *R. parvifolius*, *R. wrightii*, *R. palmatoides*, *R. phoenicolasius*, *R. hirsutus*, all $2x$; *R. sieboldii*, $4x$; *R. pectinellus*, $6x$; and *R. buergeri*, $8x$.

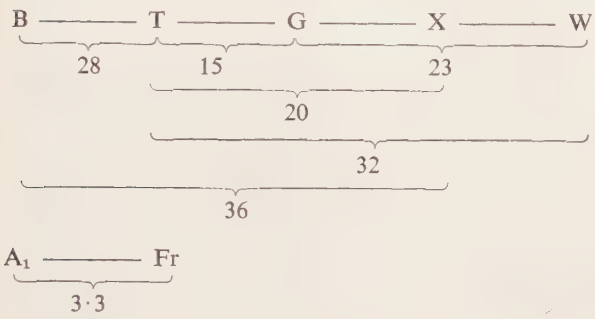
APPENDIX I

Gene List for *Rubus*

Symbol suggested	*Original symbol if different*	*Gene effect*	*Abst. no. or reference*	*Species*
A_1		*Amphorophora* resistance	K.K.B.	*idaeus*
A_2, A_3, A_4, A_5, A_6, A_7		*Amphorophora* resistance	K.B.K.	*idaeus*
B		waxy bloom on stem	597, 598	*idaeus*
Bd		secondary buds	K.	*idaeus*
ch_1	g	pale green leaf	596-598	*idaeus*
fr		'frilly' dwarf	K.K.B.	*idaeus*
H		pubescent canes	53, 255, 597	*idaeus*
P		intensifies spine colour in presence of T, gives apricot fruit with t	255, 396	*idaeus*
s		plants spineless, no stalked glands on cotyledons	597	*idaeus*
sk_1		suckering	K.K.	*idaeus*
Sk_2, Sk_3		complementary genes, when homozygous enabling Sk_1 sk_1 plants to sucker	K.K.	*idaeus*
sx_1	f	aborted female organs, undivided leaf	255	*idaeus*
sx_2	m	contabescent anthers, normal leaf	255	*idaeus*
sx_3	d	sepaloid flower	396, 597	*idaeus*
T		tinged spines, red fruit	255, 268 396, 596-598	*idaeus*
Tr		tip rooting	K.K.	*occidentalis*
w		pollen tube inhibitor	596, 598	*idaeus*
x		red hypocotyl	597, 598	*idaeus*

APPENDIX II

Gene Linkage in *Rubus idaeus*



K Keep, Elizabeth (unpublished).
K.B.K. Knight, R. L., Briggs, J. B., and Keep, Elizabeth (unpublished).
K.K. Knight, R. L., and Keep, Elizabeth. *J. Genet.* (in press).
K.K.B. Knight, R. L., Keep, Elizabeth, and Briggs, J. B. 1958. *J. Genet.* (in press).

A. and M. Berry, *see* Nessberry
Aceria (*Phytoptus*) *essigi*: 433
Acids in fruit (*see also* Vitamin C): *158*, 284, 592, 673, 674, *857*, 901
Agrobacterium (*Bacterium*, *Phytomonas*, *Pseudomonas*) *tumefaciens:* 144, 145, 238, 290, 310
Akala berry (*see also Rubus hawaiiensis and R. macraei*): 310, 723, 760
Allopolyploidy: 124, 262, 269, 345, 414, 415, 578, *683*, *685*, *688-690*, 771, 894, 984, 985, 991
Allosyndesis: 254, *645*, *707*, 776, 912
Altai
  currants: *804*
  gooseberries: *40*, *158*
American gooseberry mildew, *see Sphaerotheca mors-uvae*
Amphorophora davidsoni: 970
Amphorophora maxim: 970
Amphorophora rubi: 859, 970
  resistance (*see* Aphid *also*): 45, 65, 95, 136, 310, 498, 525, 571, 745, 793, 795, 796, 868, 970
    inheritance: 45, 65, 498, 571, 793, 795, 796, 868, p. 224
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    leaf spot: 212
    mosaic: 142, 250, 498, 745-747
      mild: 136
      mosaic 2: 203
      red raspberry: 136, 139
      yellow: 136, 139, 859
      Rubus yellow net: 860
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    yellow blotch: 214
Amphorophora rubicola: 138, 139, 970
Amphorophora rubitoxica: 859
Amphorophora sensoriata: 138, 139, 970
Andes berry, *see Rubus glaucus*
Andine currant, *see Ribes punctatum*
Aneuploidy: 266, 411, 414, 658, *690*, *921*, 966, 1005
Anthracnose, *see Elsinoë veneta and Pseudopeziza ribis*
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  host plants: 970
  resistance: 69, *79*, *86*, *511*, 868
Aphis idaei: 970
  vector of
    curly dwarf: 203
    vein chlorosis: 207
Aphis rubicola: 250, 970
Aphis rubiphila, vector of
  leaf curl: 136, 138, 139, 331, 743
  mosaic: 331, 392, 743, 745
    red and yellow raspberry: 139
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Aroma, inheritance: *577*, *578*, *690*, *968*
Ascorbic acid, *see* Vitamin C
Asexual segregation, *see* Sub-sexual variation
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  poly-haploids: 265
Auto-polyploidy: 262, 345, 414, 675, 774, 893, 894, *921*
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  breeding: 828, 831, 833, 834, 934
  environmental effects: 828
  inheritance: 122, 599, 693, 694, 819, 833, 934
  polyploidy: 257, 455, 599, 658, 828
  varieties: 71, 94, 153, 157, 169, 183-188, 190, 257, 310, 312, 559, 588, 658, 798, 799, 827, 828, 840, 850, 992, 994
  winter injury: 850
Autumn rust, *see Pucciniastrum americanum*

Bacterium tumefaciens, *see Agrobacterium tumefaciens*
Bake Apple berry, *see Rubus chamaemorus*
Bark texture inheritance: 104
Basic chromosome number: 411, *898*, *917*
Bedford Giant, *see* Blackberry and hybrid berry varieties
Biennial bearing: *461*
Big bud, *see Phytoptus ribis*
Big bud, false: *630*
Big-Ness berry, *see* Blackberry and hybrid berry varieties

*Numbers refer to Abstracts not to pages; those in italics refer to *Ribes*, those in Roman refer to *Rubus*.

Blackberry and hybrid berries: 128, 257
breeding: 302, 303, 536, 661, 837, 938
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Pacific coast: 194, 297, 302, 314
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Blackberry and hybrid berry varieties: 110, 111, 113, 114, 126-129, 155, 233, 261, 295
Acme Thornless Young: 183
Advance: 310, 316, 808
Agawam: 310
Alfred: 68, 119, 316
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Ancient Briton: 310
Andean, *see Rubus glaucus*
Armeniska: 684
Ashton Cross: 274, 276, 853, 854
Austin: 119, 661, 677
Austin Thornless: 57, 82, 202, 293, 302, 310, 314, 315, 661, 866
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Cameron: 48, 185, 310, 315
Cascade: 97, 183, 316, 358, 935, 936, 962
Chehalem (Oregon 731): 73, 97, 187, 538, 962
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Cory Thornless (Thornless Mammoth): 202, 257, 293, 316, 661, 863, 866, 868, 959, 960, 1003
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Crandall (Everbearing, Macatawa): 120, 284, 310, 316, 661, 920
Crystal White: 310, 661
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Dallas: 24, 316, 661, 677
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Early Wonder, 310, 316, 799
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Edward Langley: 257, 303, 310, 484-486
Eldorado: 24, 96, 238, 310, 314-316, 525, 799, 868, 937
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Erskine Park: 310
Eureka: 303, 310
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Van Fleet: 29
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blackberry: 920
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R. neglectus: 893
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